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COMPUTER SCIENCE BOOK 2

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LEARNING ESSENTIALS

Computer Science
Book 2

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PREFACE

This book is the second in a series that aims to provide a solid foundation and understanding of computer science. In our world today, computer technology has increasingly begun to shape the way we learn, do business and interact socially. This book therefore gives students an in-depth understanding of how computers work and why they are essential in education, the business world and society as a whole. Computer science study farther provides students with knowledge of responsible, ethical and legal uses of technology. This book conscientiously covers the topics required for the new curriculum approved by the Ministry of Primary and Secondary Education.

The topics are listed as follows:

- Hardware and software
- Application of computer Science
- Data Representation
- Communication Networks and Internet Technologies
- Security and Ethics
- System Analysis and Design
- Algorithm Design and problem Solving
- Programming
- Databases
- Web Design
- Technoprenuership

It is hopefully the beginning of a successful and rewarding journey into the study of an evolving science with huge opportunities for growth and innovation.

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Security and Ethics (Unhu/ Ubuntu/ Vumunhu)

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Web Designing

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Chapter 1
Hardware and Software

In this chapter you will learn about
- Types of application software
- Use of utility software and Tools

Introduction

In this chapter you are going to focus on types of computer application softwares, how they are grouped into classes according to how they perform. We are also going to look at system optimization and system software Utility tools.

Every computer must be told exactly what to do and how to do it by a human. The instructions humans give computers are called programs or software. Without a software to tell them what to do, computers would be useless.

Applications Software

While system software comprises device drivers, Operating System, servers and software components, programming software helps in writing programs through tools such as editors, linkers, debuggers, compilers/interpreters and ore.

Application software , in contrast to these two, is used for attaining specific tasks. Application software uses the capacity of a computer directly for specific tasks and are used to manipulate text, graphics and numbers.

Application software, or simply applications, is often called end-user programs because they enable the user to complete tasks, such as creating documents, spreadsheets, databases and publications, doing online research, sending emails, designing graphics, running businesses, and even playing games! Application software is specific to the task it is designed for and can be as simple as a calculator application or as complex as a word processing application. When you begin creating a document, the word processing software already sets the margins, font style and size, and the line spacing for you. But you can change these settings, and have many more formatting options available. For example, the word processor application makes it easy to add colour, headings, and pictures or delete, copy, move, and change the document's appearance to suit your needs.

The different types of application software include the following:

Application Software Type	Examples
Word processing software	MS Word, WordPad and Notepad
Database software	Oracle, MS Access etc
Spreadsheet software	Apple Numbers, Microsoft Excel

Multimedia software	Real Player, Media Player
Presentation Software	Microsoft Power Point, Keynotes
Enterprise Software	Customer relationship management system
Information Worker Software	Documentation tools, resource management tools
Educational Software	Dictionaries: Encarta, Britannica Mathematical: MATLAB Others: Google Earth, NASA World Wind
Simulation Software	Flight and scientific simulators
Content Access Software	Accessing content through media players, web browsers
Application Suites	OpenOffice, Microsoft Office
Software for Engineering and Product Development	IDE or Integrated Development Environments

There are different types of application software such as licensed, sold, freeware, shareware, and open source. Application software either needs to be installed on your computer or can run online. Application software can also be classified on the basis of usage into the following:

- Off-the shelf software
- Open source software
- Bespoke software
- Utility programs
- Generic programs
- Integrated programs
- Specific software
- Word processing software
- Desktop publishing software
- Spreadsheet software
- Database software
- Presentation software
- Internet Browsers
- Email Programs
- Graphic Programs (Pixel based)
- Graphic Programs (vector based)
- Communication software: Communication through audio, video or chat based means

The three major classes of application software we are going to discuss are bespoke, off-the-shelve and open source software.

Bespoke/Tailor made

It is known as custom-made and tailored software and it is specially designed and written for a specific solution inside a single organization for specific business needs.

Some specific business may not find a ready-made solution to fit their needs, for example, scientific projects, space projects etc.

Moreover, some applications have been developed to target specific users, for example, mobile applications for a specific need for the business.

If we would like to use a metaphor in the physical world, we can choose Cars, for example, some banks need specific cars to transfer money from one location to another. These cars have been made for that purpose and cannot be reused to be a personal or a family car. They are tailored especially based on the bank security needs.

Examples of Bespoke/Tailor made

Content Management System (CMS)

A content management system (CMS), is an example of bespoke software. It caters for the needs of the average consumer, and allows developers to add features and make improvements along the way. Let's assume you want to buy shoes online, how do you expect the a website to look like? Discuss with your friend.

First, you want to see a menu that's easy to navigate through; second, you want to see great pictures and a simple buying procedure third, you want to be able to talk to someone in case you have any questions and you also want a responsive website design that allows you to visualise and make a purchase from a smartphone or iPad. WordPress, for example, is an excellent type of CMS software. The platform is easy to use and customize. It facilitates social media integration, website maintenance, online security, and more.

Customer Relationship Management (CRM)

This example of bespoke software keeps track of customers, vendors, prospects and referrals. The tools available are numerous, and startups are at liberty to choose only the ones that best complement their business needs. SaleForce is an example of a customer relationship management software. The platform advises business owners to focus more on innovation rather than on infrastructure and embrace customization.

Company-Facing / Customer-Facing Web Portals

Another great type of bespoke software is a web portal, which is actually an informational website that permits customers and employees to get informed and stay updated with recent trends. Company-facing portals target staff members only. Employees log in to know more about company requirements, demands, projects, training courses, and more. eXO Platform is an excellent type of web portal for business. The social-collaboration open-source software targets businesses of all shapes and sizes. It helps startups connect with customers, developers and employees via a content-driven, social and collaborative dashboard.

E-commerce software solutions

Some businesses sell products to boost revenue in addition to offering services. Owning an online store and having it integrated into your company's existing website can be done properly with e-commerce software solutions. Shopify.com for example, helps companies develop computer software for their retail point-of-sale systems and online stores. Selling goods online, customising your storefront, tracking payments and organising products has never been easier.

Automated Invoicing

If you choose to move my business online, use cloud-based solutions to share information with employees and customers, and track productivity, how do you manage paperwork without burying your head in documents? It is people walking into your office asking to sign them every little piece of paper. Tipalti, is an example of bespoke invoice-to-pay software solution.

Advantages of Bespoke/Tailor made

- You determine how your system will work - Bespoke solutions are custom built to suit your business' specific needs and requirements, which gives you the opportunity to configure the software around your existing processes, which is a more flexible approach than off the shelf systems provide.
- Flexible approach compared to off the shelf systems - if what you do or what you need your system to do is so unique that you wouldn't find an off the shelf package that would accommodate your needs.
- Potentially provides a competitive advantage - Bespoke development can also provide your organisation with a competitive advantage as your business can work in a different way to other companies in your sector or industry.

Disadvantages of Bespoke/Tailor made

- High initial purchase cost - they come with a substantially high initial purchase cost, this can often lead people to believe that they are more expensive than an off the shelf solution.
- Lengthy development time frames - Bespoke software solutions can take months and years to develop, which means that your business will not solve any of your existing operational issues in a short time frame.
- No online community support for users - Having a unique system that is built to meet your needs means that your users will not have any form of online support through forms and guides that off the shelf packages usually provide.
- High-risk solution - there are risks associated with a one of a kind system. What if it crushes?

Off-the-shelf (OTS)

"Off The shelf" just means you didn't develop it yourself. This kind of software is designed to provide a general set of features that a broad range of customers will

find useful, it is also called ready-made software. The off-the-shelf software can be commercial (COTS) or non-commercial, for example, Microsoft Office, and web browsers. These kinds of software have been built to reach different types of users who have a common need, for example, in Microsoft word, the users may need to create, write, read, and edit documents. They will find Microsoft word satisfying their needs meaning no need to build a new software for document processing. Also, the same can be used from non-commercial software, like Open Office or even cloud applications, like google docs.

If we talk the same metaphor, some vehicle manufacturers have product lines for a sedan, SUV, and sport cars to fit general needs of the public, which anyone can find suitable for their general needs.

Examples of Off-The-Shelf Software

1. **Word processing application** - writing reports, memos, letters to customers
2. **Spreadsheet application** - keeping simple company accounts, calculating employee commission payments, simple stock control system, modeling
3. **Database application** - keeping customer records, sales records, appointments system
4. **Desktop publishing application** - creating leaflets, posters, business cards
5. **Presentation software** - creating presentations to show to customers or staff
6. **Graphics application** - manipulating images that can be used at home, school or a business
7. **Web design application** - creating personal or business web sites

Advantages of Off-the shelve software

- Initially cheaper than bespoke development - Off the shelf software tends to be cheaper than bespoke development at the initial purchase stage, which tends to be the reason why so many companies choose pre-configured systems.
- Quick implementation, most systems are ready to use straight away - They are often available to implement straight away, so you can have your team or department using the system within days or weeks.
- Online guides and forums to support your users - off the shelf software packages are used by other businesses and users, so there is usually a variety of guides including books, tutorials, best practices and other resources available online to turn to for support. .
- Regular upgrades are available - Vendors who supply off the shelf software also tend to provide regular upgrades so that you will have an up to date system.

Disadvantages of Off-the Shelve Software

- Expensive or impossible to change.
- Unnecessary features and functions that you will have to still pay for.
- Upgrade and support costs- Support from software vendor will usually come at a cost, and some providers may stop your support if you refuse to upgrade your system to the latest version.

- Limits your control on how your business operates- your business will have to work with the software, rather than the software being configured to suit the way your business works/operates.

Open source software

Open-source software (OSS) is a computer software distributed with its source code available for modification. The software usually includes a license for programmers to change the software in any way they choose. They can fix bugs, improve functions, or adopt the software to suit their own needs.

Licenses

Different licenses allow programmers to modify the software with various conditions attached. 5 of the most popular licenses according to the Black Duck Knowledgebase are:

1. MIT License
2. GNU General Public License (GPL) 2.0
3. Apache License 2.0
4. GNU General Public License (GPL) 3.0
5. BSD License 2.0 (3-clause, New or Revised)

When you change the source code, one requirement of OSS is the inclusion of what you changed as well as your methods. The software created after code modifications may or may not be made available for free.

Popular Types of Open-Source Software

Many of the programs you use every day are based on open-source technologies. For example, Android OS are based kernel and Apple's OS X on the Unix/BSD open-source technologies.

Other popular open-source software is:

- Mozilla's Firefox web browser
- Thunderbird email client
- PHPscripting language
- Python programming language
- Apache HTTP web server
- database system

Open-Source versus Commercial / Closed Software

Open-Source	Commercial Software
OSS, on the other hand, is a collaborative effort -- the software is shared intellectual property among all who have helped develop or alter it.	Commercially available software, or proprietary software, doesn't give access to its source code because the software is someone else's intellectual property. As a result, users often pay for it.

Open-Source Software Vs. Free Software

Open-Source Software	Free Software
Open Source means the free availability of source code and distribution. Free software, includes code modification but emphasizes the freedoms users enjoy to do what they like with the software.	The software can be classified as freeware. This means users download the software at no cost, but they cannot make any changes to its source code.

Advantages of Open-Source Software
- When the source code is passed around, tested and fixed, high quality results are produced
- This is a learning opportunity for programmers. They can learn and apply skills to the most popular programs available today.
- Many consider open-source software more secure because bugs are identified and fixed quickly.
- Open source software is always available. This is important for long-term projects that rely on these tools for the duration of the project.
- Most of the software is free. Except for subscriptions or support fees.

Disadvantages of Open-Source Software
- Open source software tend to evolve more in line with developers' wishes than the needs of the end user.
- They can be less "user-friendly" and not as easy to use because less attention is paid to developing the user interface.
- They may provide less support when things go wrong – open source software tends to rely on its community of users to respond to and fix problems.
- Although the software is mostly free, there may still be some indirect costs involved, such as paying for external support
- Malicious users can potentially exploit open systems.

Let's compare the three categories of software

	NAME OF APPLICATION SOFTWARE		
Criteria	Bespoke	Off-the-Shelf	Open source
Flexibility and Customizability	Very customizable based on the requirements	Rigid, but you can ask for new features.	Flexible and you can ask new capabilities but with caution, for example, for new upgrades, these newly developed capabilities may need some adjustments
Control	100% of the control over the output	You do not have the control	Limited control.

Functionality	Can cover up to 100% of business needs	Based on the available features of the application	Can cover up to 100% of business needs
Help and Support	Mainly its the team, company, person who developed the application who can provide its support. If the team or company does not exist anymore, you may face some issues to add or change the functionalities.	It is the software vendor who can provide the help and support. Also, some communities can support.	It is the software vendor who can provide the help and support, besides the team who implemented the customization and this team can be a different team for standard products
Training	Training can be easier as it has been tailored to match the business needs and processes.	Training can be provided by the vendor, or maybe you will find a lot of online resources for that.	Similar to off-the-shelf
Integration	It can be built to integrate the currently existing systems	Some of them provide integration capabilities out of the box	Some of them provide integration capabilities out of the box
Cost	Highest cost, while it is not always the case if compared with some ready-made products.	Lowest cost, as it targets many users	The cost is mainly in between, as there is additional customization cost
Time	Takes too long	Faster time to gain value	It is fast if you will use the out of the box features then customize later in other phases
Internal capabilities	If you do not have the team to build the application, you can outsource it.It is important to choose a reliable company at this stage	Mainly, you will buy the license and do not need to have any capabilities in the team. You do not have any control over the application software	You may need the team that is able to customize the product for the business needs or outsource it. Different companies or teams can build or change the new capabilities.
Expandability and scalability	It is subject to how the software has been developed, it is scalable or not	Because it is developed for common needs, it should be scalable	Because it is developed for common needs, it should be scalable

System Utility Software/Tools

System Utility tools can help you fine-tune your system to achieve better application-loading times, Operating System start-up times etc. By using applications from this

category you can optimize your system's performance and get rid of things you don't need, e.g. junk files. Utility software helps to manage, maintain and control computer resources. They are pre-written programs, widely used in mainframe computers by system programmers and application developers to achieve day-to-day requirements, organising and maintaining data. A few of them are listed below with their functionality.

Below are just some examples of system optimization tools. This can be downloaded from the internet easily. Some of them are for free but some need to be purchased.

RAM Memory Cleaner and Optimizer

RAM Memory Cleaner and Optimizer is a clever memory management program that will keep your computer (PC) running better, faster, and longer. It allows you to instantly free up memory when your system slows down. When you are working with near-zero megabytes of RAM, your computer will load your files and programs slowly, and may freeze. When your computer needs more memory, after the RAM is used up, it uses the hard disk. Your apps as Word, IE or antivirus will benefit from this innovative program using the released memory.

Smart Javascript Error Fixer Pro

Smart Javascript Error Fixer Pro is a powerful program designed for fixing JavaScript errors. You can scan, clean, optimize, and keep your PC much healthier. It is an error-resolution registry cleaner which will fix the computer errors and optimize the system settings.

Registrar Registry Manager

Registrar Registry Manager is an advanced and complete suite of tools that allows you to safely maintain your local registry as well as the registries on the systems of your network. Since many years, Registrar Registry Manager has been the expert's choice in registry management.

PowerTools Lite

PowerTools Lite detects and fixes registry errors, finds and cleans unneeded registry junk, finds leftover temp files, clears History and MRU data. It is safe to use, thanks to its automatic backup feature and it has a multilingual user interface.

System TuneUp

System TuneUp is a collection of tools to optimize your Windows PC's performance. It can remove invalid entries from Windows registry, removes Internet browser history and cache, and clean Cookies and HTML5 data stored by all browsers. It can also erase the usage-history for over 300 third-party applications.

SysInfoMyWork

SysInfoMyWork shows CPU load and free or occupied memory information on a small, animated icon in taskbar notification area, called tray.

Main features:
- Track your system\PC resources.
- Memory and CPU load monitor.
- Simple, user-friendly interface.

System Optimisation in System Utilities

We all know how frustrating it can get when our PC runs slowly and takes infinitely long to perform the simplest of tasks. A slow computer ends up wasting time, effort and money in the long run. While you can always approach a technician to repair your Windows PC and get it up to speed, following certain fundamental rules of maintenance can usually help you fix the system on your own. Below, we are going to look at how to optimize Windows 10, Windows 8 and Windows 7 Personal Computer (PC) performance.

Optimising Windows 10 Pc Perfomance

1. Disable transparency effects
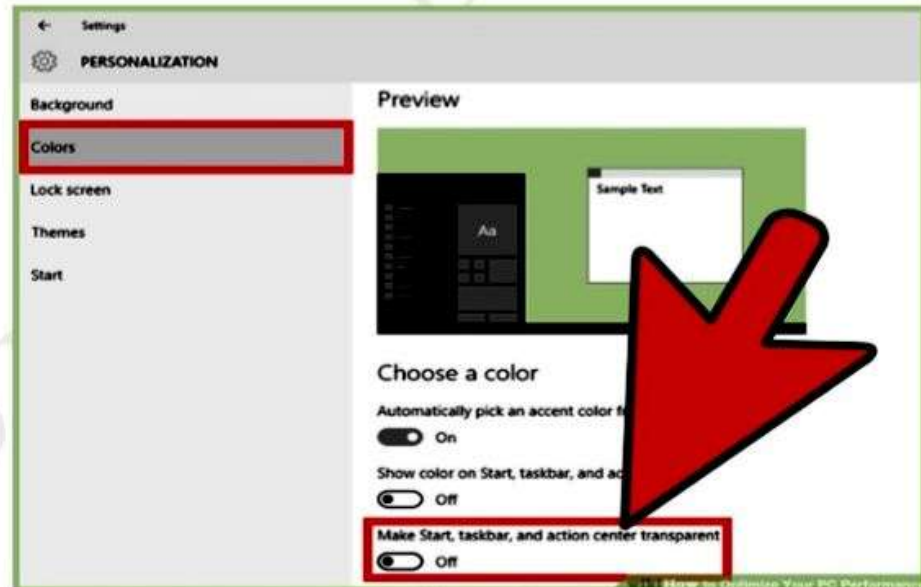
These special effects look impressive, but guzzle down too much of your PC's resources. Turn off these effects and instead, go for that classic Windows look, to speed up your computers performance.

1. Right-click the desktop.
2. Select "Personalize".
3. Select "Colors".
4. Disable "Make Start, taskbar, and action center transparent".

2. Disable startup programs.
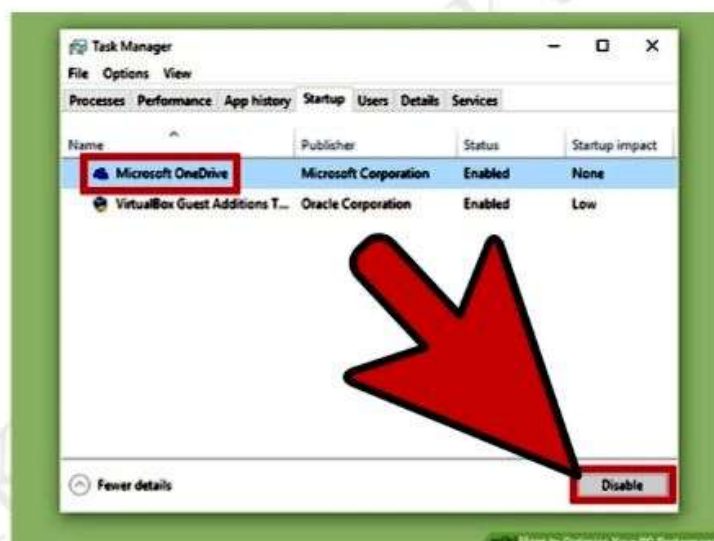
Several programs contain a component that automatically runs at startup. While this is convenient for programs you use often, running unwanted software at startup could slow down your computer. Here is how to disable startup programs:

1. Right-click the Start button.
2. Click "Task Manager"
3. Click "Startup"
4. Select the program you want to turn off.
5. Click "Disable".

3. Disable unnecessary services

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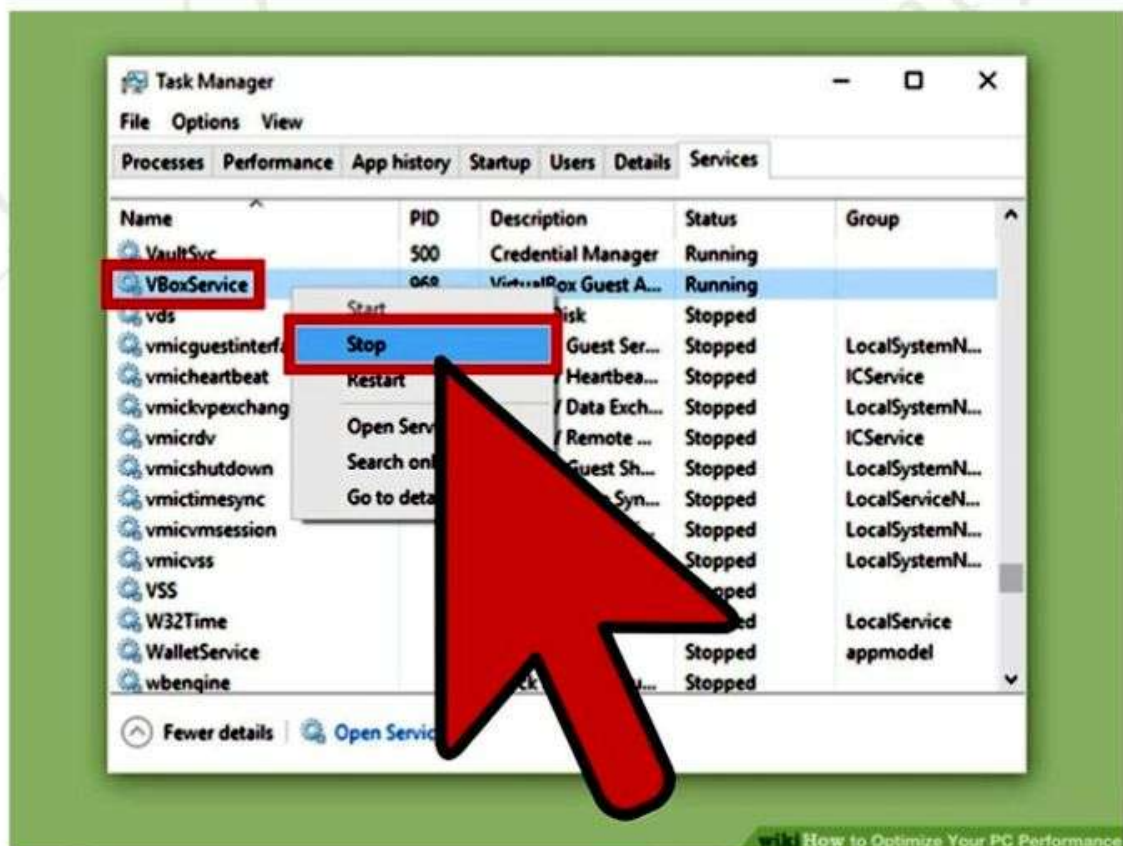
Some services are crucial to the functioning of Windows. While there are many Windows-specific features which are enabled by default, there are a few that you do not really need. You can choose to disable these services, either temporarily, or permanently.

1. Right-click the Start button.
2. Click "Task Manager".
3. Click "Services".
4. Right-click the service you wish to disable.
5. Select "Stop".

4. Disable shadow and animation

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Shadows and animations look nice on screen. However, they unnecessarily add to the CPU's (Central Processing Unit) load.

1. Choose "System"
2. Click "Advanced system settings".
3. Click the "Advanced" tab.
4. Under "Performance", click the "Settings" button.
5. Click "Adjust for best performance". You can also manually disable each effect.
6. Alternatively, go to Settings > Ease of Access > Other Options. Once here, you can turn off animations.

5. Enable fast start up

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Windows 10 offers you this nifty feature to speed up your computer. When you shut down your PC, Windows will save an image of your loaded drivers and kernel in a separate file, called "hiberfile". So when the system boots again, the system simply reloads this file, thereby reducing startup time.

1. Right-click the Start button.
2. Go to "Control Panel".
3. Choose "System and Security".
4. Click "Power Options".
5. Click "Choose what the power buttons do".
6. Click "Turn on fast startup". You will find this under Shutdown settings.
7. Click "Save changes".

6. Uninstall unnessary program

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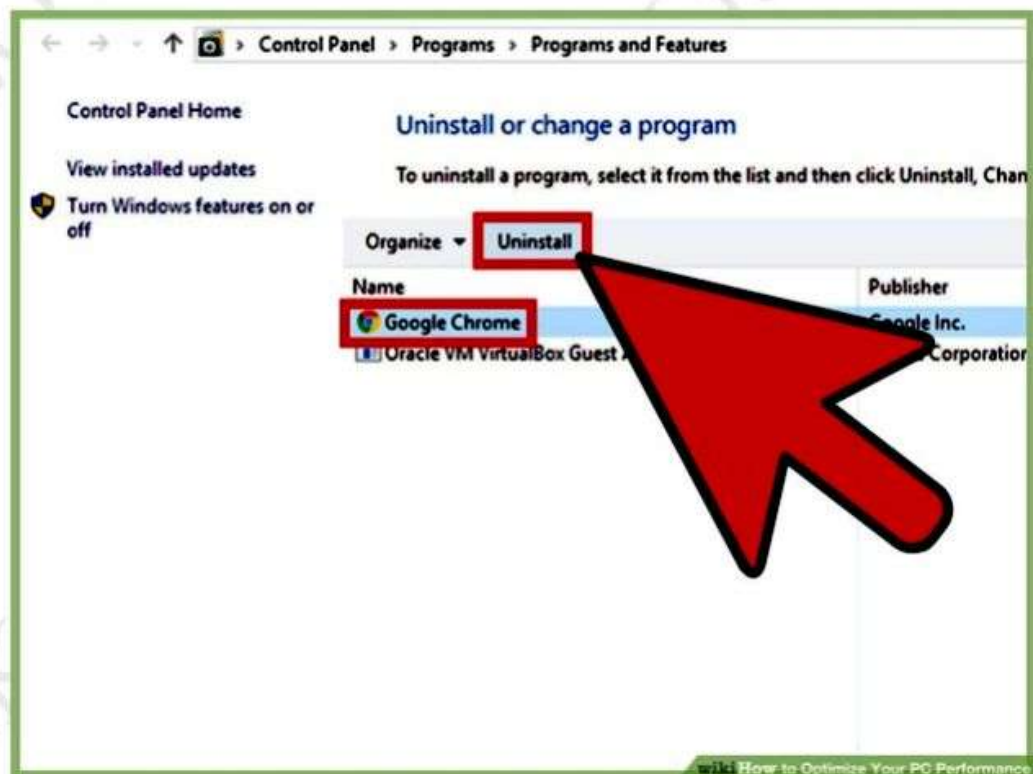
It is desirable to uninstall programs which we no longer use. Sometimes, we install trial versions of software, which we then forget to remove, after the expiry of the trial period. Such programs take up memory and eventually slow down the computer.

1. Right-click the Start button.
2. Click "Programs and Features".
3. Select the software you wish to remove.
4. Click "Uninstall/Change".

7. Defragment your hard drive

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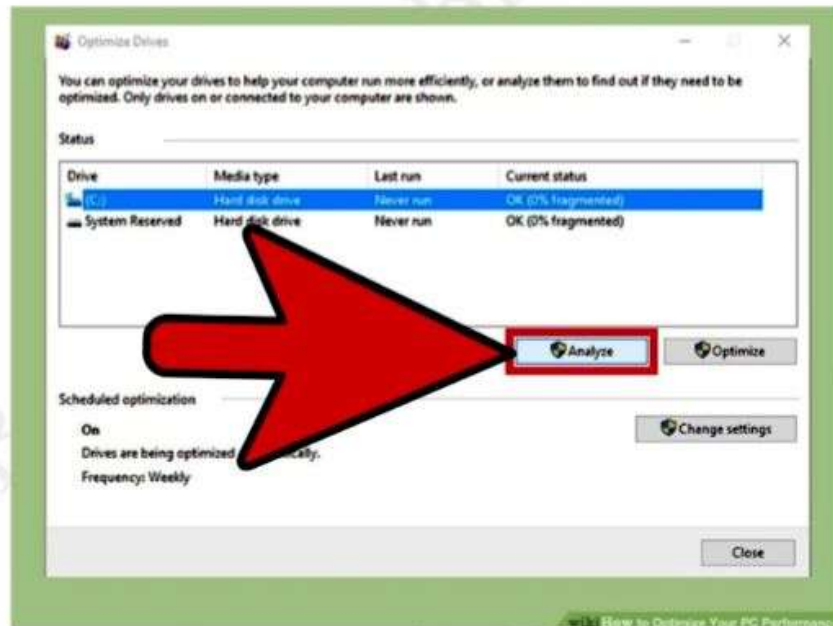
When too many files in your hard disk are in different places or clusters or "fragmented," your computer slows down. When you defrag your drive, the pieces of files are moved to locations that are contiguous (beside each other). This makes it easier for your computer to read the files. There are at least two ways to open the Optimize Drives dialog box—by using Cortana and by using File Explorer—and from there, you defrag your hard disk. Note that you must sign into an Administrator account in order to defrag your hard drive

Using Cortana search box

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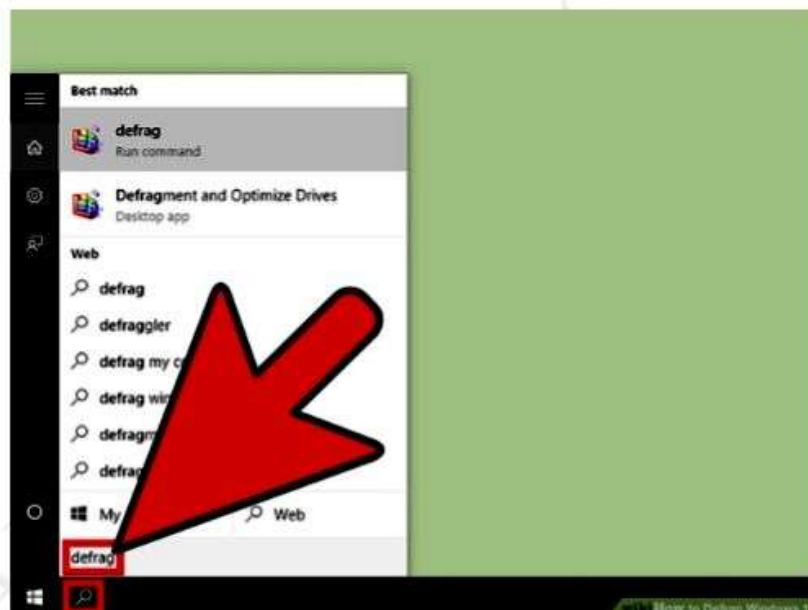
Type "defrag" in the Cortana search box. You will find the Cortana search box at the lower left side of the desktop beside the Start button shown as a magnifying glass icon. As you type, a list of search results will appear on the Cortana search window. When you finish typing "defrag," the Defragment and Optimize Drives (Desktop app) option will appear at the top of the search window.

Click/tap "Defragment and Optimize Drives (Desktop app)." This will open the Optimize Drives dialog box. If you are not signed into an Administrator account, right-click (press and hold) "Defragment and Optimize Drives (Desktop app)" and choose "Run as administrator" when the pop-up menu appears.

Highlight the drive you want to defrag. In the Optimize Drives window, you will see a box labelled "Status" inside of which is a table where the rows list all the drives in your device as well as all storage media connected to the device. The columns have the following headings (from left to right): "Drive," "Media type," "Last run," and "Current status." Highlight the drive you want to optimize by clicking/tapping on it.

- For each drive listed, you will see its Current Status in the last column, which tells you how fragmented your drive is and advises you on what to do ("OK," meaning "no need to defrag," or "Needs Optimization").

Using File Explorer
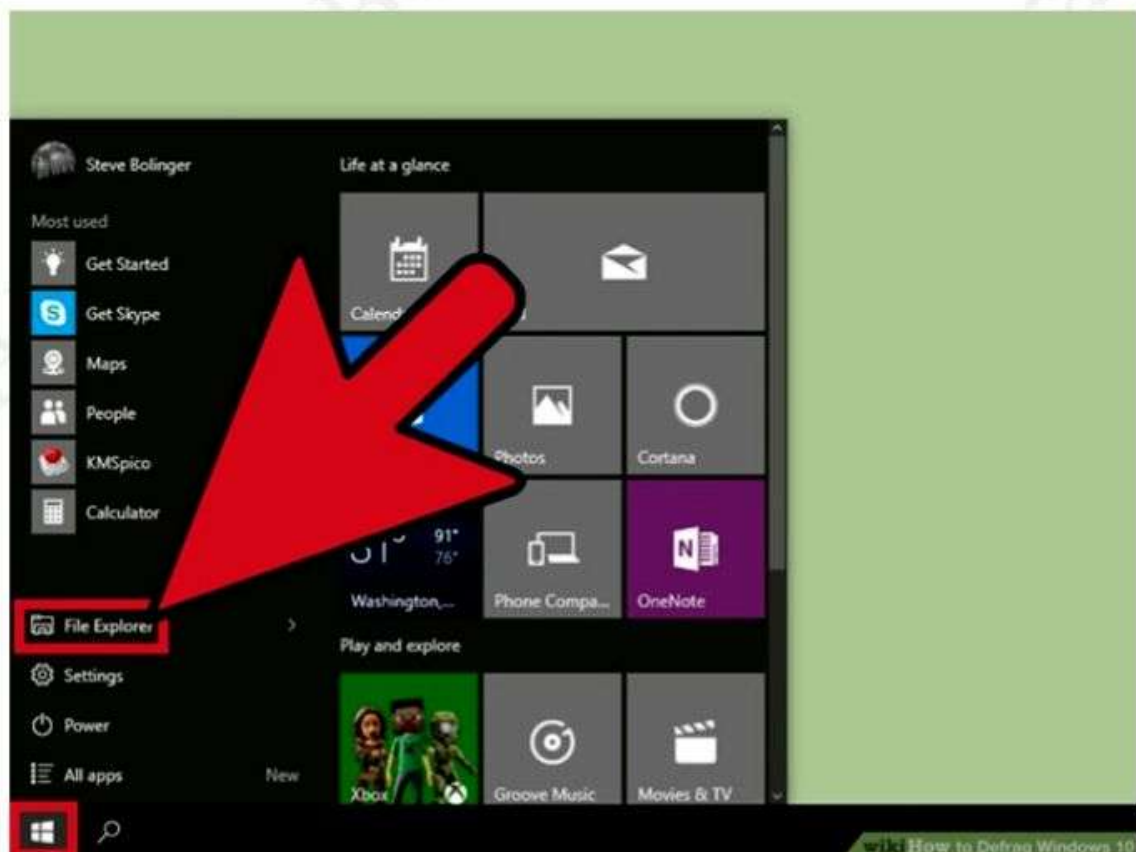
Open File Explorer. Click/tap the Start button which is located at the bottom left-hand corner of your desktop to open the Start menu. Hitting the Windows key on your keyboard has the same effect as clicking the Start button.

- Click/tap the File Explorer button, which can be found at the lower portion of the Start menu. This opens the File Explorer window.
- In the left pane of the File Explorer window is the directory tree. Under the "This PC" directory, you will find the main directory entries as well as the hard drives and other drives connected to your PC.

Choose the drive you want to defragment. If your hard drive is not partitioned, you will find only the system drive C:. Other drive letters will appear if your hard drive is partitioned, you have another hard drive installed, or if you have other drives or storage media connected to your device.

- Click/tap the drive you want to defragment. When you click the drive you want to defragment, the Drive Tools/Manage tab will be added to the ribbon on top of the File Explorer window. The Application Tools/Manage tab appears only when specific options are available.

8. Regularly perform cleanup.
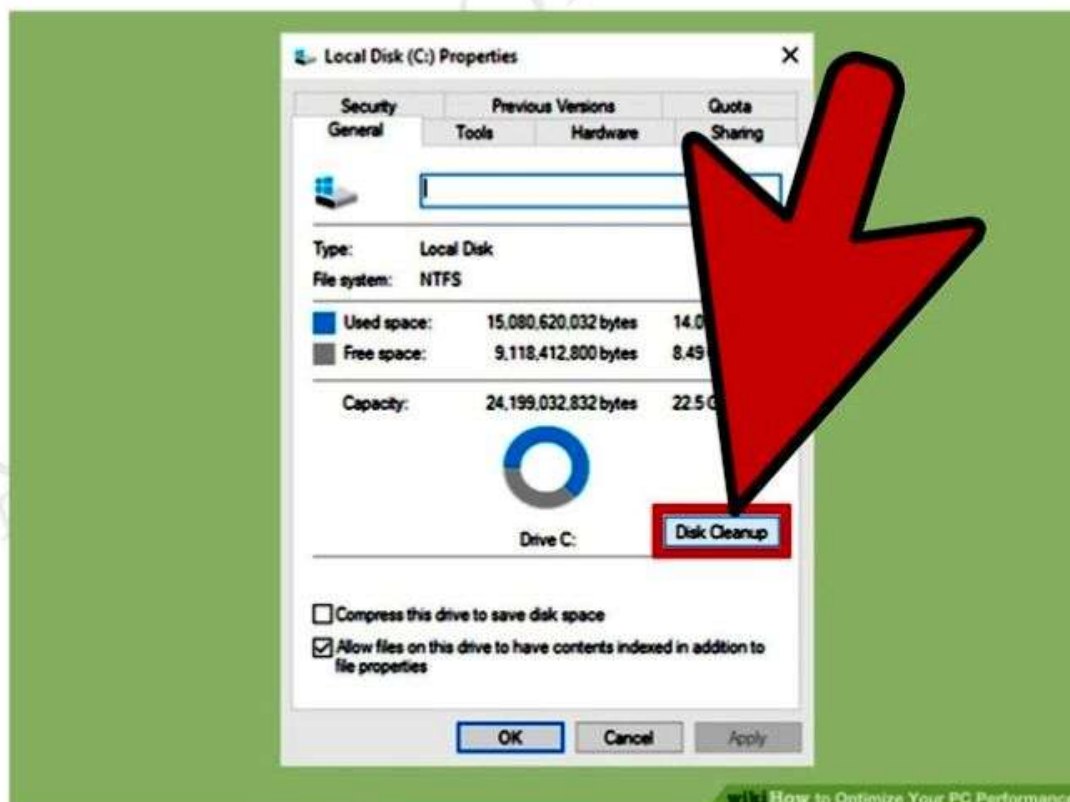
Disk Cleanup is a great built-in tool that Windows offers you. Using this, you can get rid of unnecessary files in your PC.

1. Click the Start button.

2. Click "File Explorer".
3. Right-click Local Disk C:.
4. Choose "Properties".
5. Click "Disk Cleanup". You will find this under the "General" tab.
6. Click "Unnecessary files
7. Once you are done, click "OK".
8. Advanced users can avail the "Clean up system files" feature.

Optimising windows 8 pc perfomance
1. Disable animation

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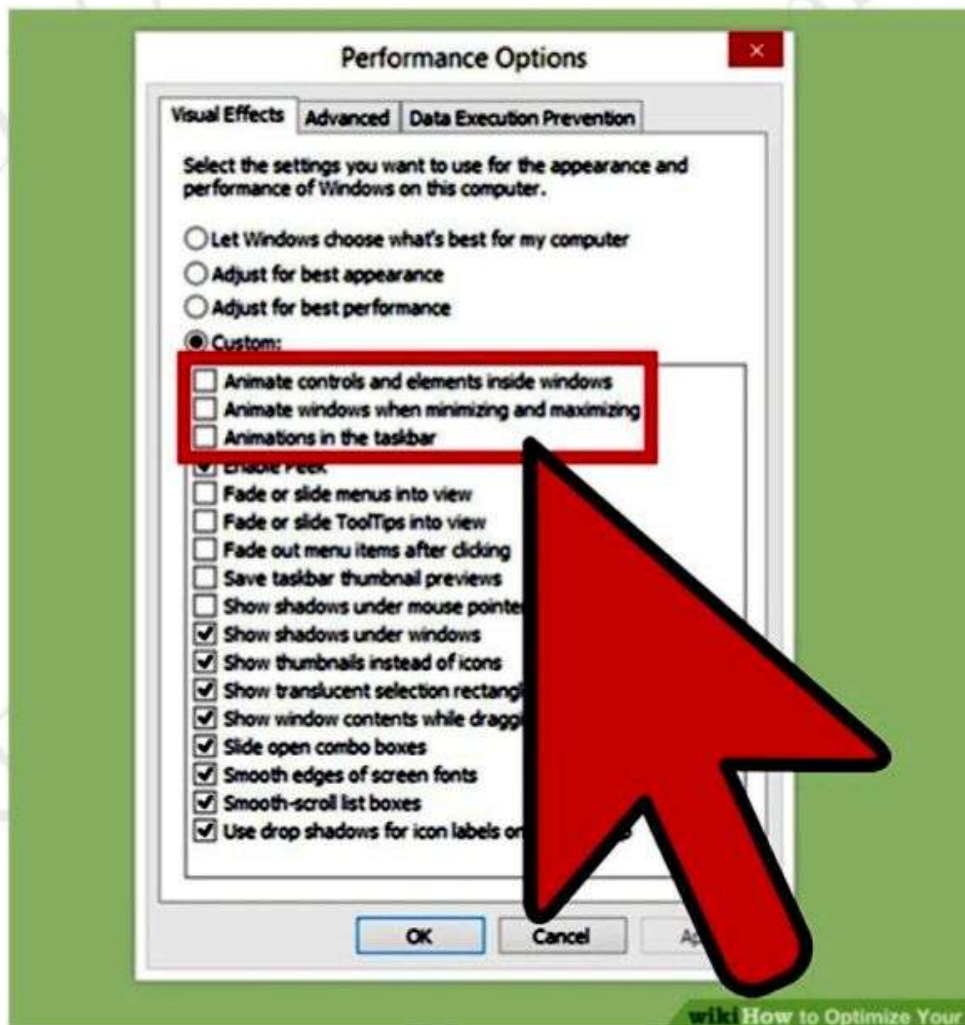
Animations, which are so much part of Windows 8, can cause a sort of time lag, while moving from screen to screen. To disable animations, do the following:

1. Click the Windows key.
2. Type "System Performance Properties".
3. Click "Enter".
4. Uncheck the "Animate windows" box.
5. Disable some other animations, if you so wish.

2. Determine which apps use the most resources.
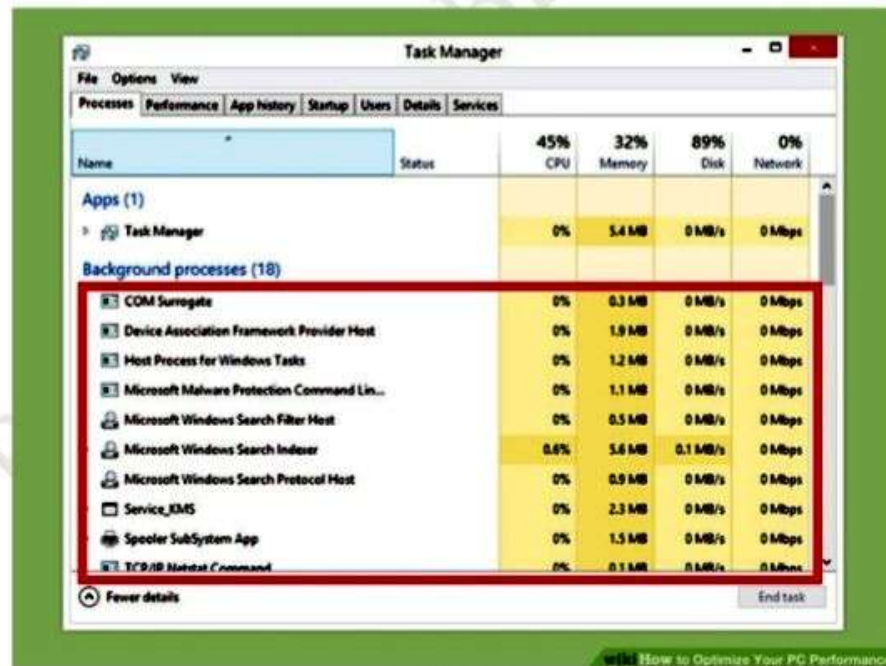
You can use Task Manager to find out which programs use the most resources.
1. Right-click the desktop taskbar.
2. Select "Task Manager".
3. Click "More details" in case you wish to see the full interface.
4. Apps using a lot of resources will be highlighted.

3. Change power settings.
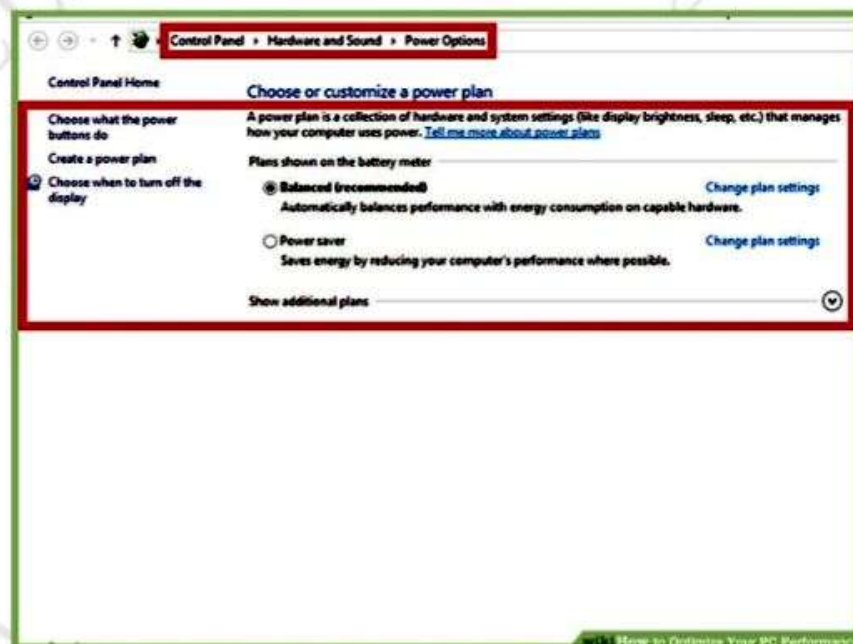
Windows offers you a Power Plan and Settings Tool, which you can use to optimize the amount of power consumed by your PC. These plans help your computer save energy, to offer maximum performance.

1. Click on the battery icon. This is visible on the taskbar of your PC.
2. Choose "More power options".
3. Select from three plans, namely, Balanced (this offers full performance and saves power while inactive), Power Saver (saves power by reducing system performance) and High Performance (maximizes performance and responsiveness).
4. You can change your plan by clicking the Change Plan Settings link.
5. To configure an Existing Plan, you can select/change the SLEEP and DISPLAY power plan settings.
6. To create a Custom Plan, you have to go to the "Create a Power Plan" window. Give it a name and click "Next". Then go about configuring your settings.

3. Change Windows indexing.

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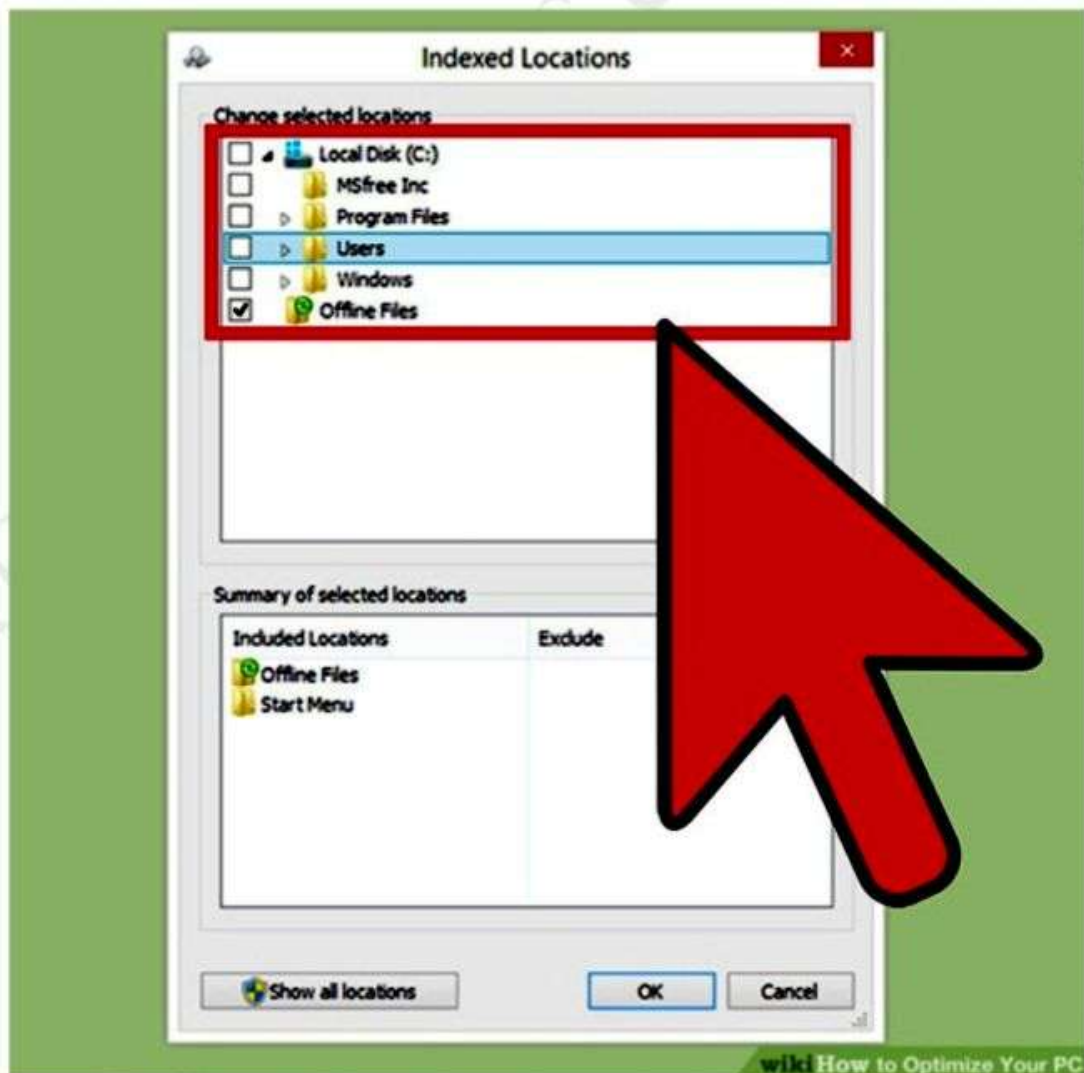
Windows 8 maintains and constantly updates files and folders to return quicker search results. While this is convenient, keeping information that you do not need often, could eventually end up slowing down your PC. Here is how you can disable indexing:

1. Click on Start.
2. Type Indexing. Next, you will see the currently indexed locations.
3. Click the Modify button.
4. Uncheck the locations that you do not want indexed.
5. To turn off indexing on a drive, open Computer and right-click on your local drive.
6. On the General tab, uncheck the box that says, "Allow files on this drive to have contents indexed".
7. Choose all the folders and subfolders which you do not want indexed.
8. Restart your computer for the changes to take effect.

4. Optimize your PC's hard drives.

https://www.wikihow.com/Optimize-Your-PC-Performance

In Windows 8, the Disk Defragmenter has been named as "Optimize Drives". Here is how you can optimize your PC's hard drives:

1. Click on the Charms Bar.
2. Click "Optimize Drives". This will open a new dialog box, displaying the list of drives.
3. Select a drive of your choice.
4. Click on Optimize. This starts the defragmentation process.
5. You can schedule this process to run automatically.
6. Click Change Settings.
7. Select the "Run on a Schedule" checkbox.
8. Click OK to save your schedule.

Optimising windows 7 pc perfomance
1. Clean up your hard disk.

https://www.wikihow.com/Optimize-Your-PC-Performance

Use a program such as Disk Cleanup to remove temporary files, system files and a variety of other files that you no longer use.

1. Open the Start menu.
2. In the Search box, type cleanmgr.
3. Click the Cleanmgr program.
4. Specify the drive you would like the program to clean up.
5. Click OK. This will start the process.

2. Run the Performance troubleshooter.
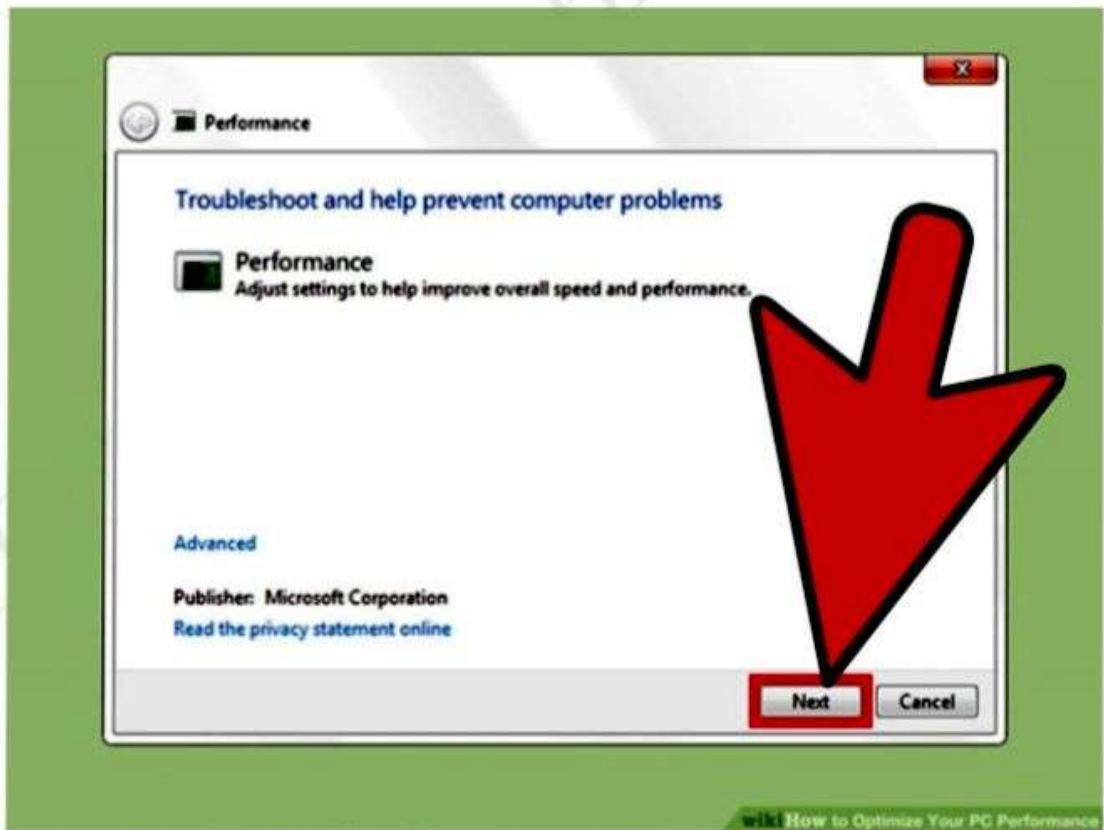
This program repairs performance issues related to your Windows PC and speeds up slow computers.

1. Click the Start button.
2. Click on "Control Panel".
3. Under "System and Security", click "Find and Fix Problems".
4. Click "Check for performance issues".
5. A Performance Wizard window pops up. Click "Next" and wait for it to diagnose the problem.
6. In the event that the troubleshooter recommends that you check programs to tweak PC performance, click "Next".
7. Clicking the "View detailed information" lets you access the detailed troubleshooting report.
8. If you wish to close the wizard, you simply need to click "Close".

3. Uninstall and delete unused programs.

https://www.wikihow.com/Optimize-Your-PC-Performance
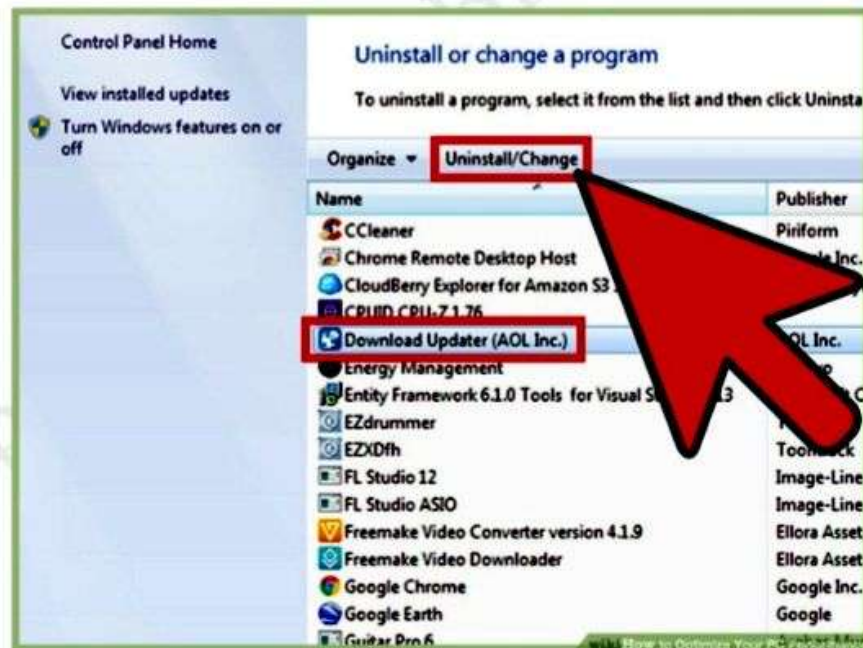
Unused programs can end up taking a lot of space on your computer, thereby reducing its performance, over a period of time. It is advisable to delete such programs.

1. Click the Start button.
2. Click on "Control Panel".
3. Under "Programs", click "Uninstall a program". This will bring up a list of all your programs.
4. Click the program you wish to remove and click "Uninstall". You will find this tab on the top of the menu.

4. Limit programs at startup.

https://www.wikihow.com/Optimize-Your-PC-Performance
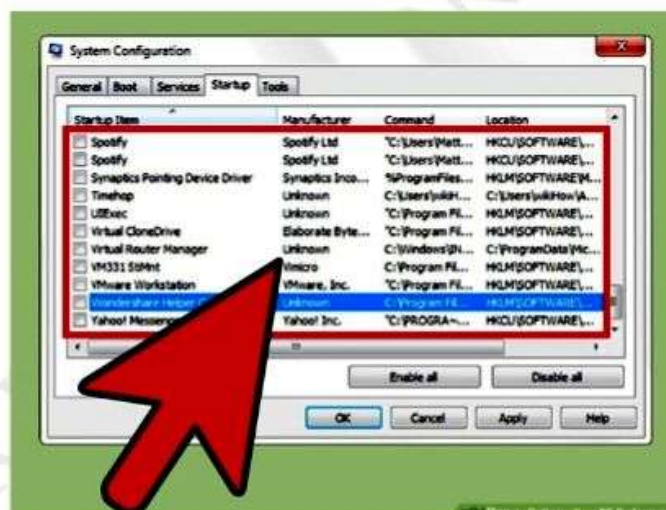
Many programs are designed to run automatically at startup. While this is convenient for programs you use often, unnecessary software running at startup could guzzle down memory, eventually slowing down your PC. You can manage startup programs in several ways.

1. Press Win-r on the desktop.
2. In the "Open" field, type msconfig.
3. Press Enter.
4. Click Startup.
5. Uncheck the items which you do not want to launch at startup.
6. Once you are done, click OK.
7. In the popup box that appears next, click Restart. This will restart your computer, to finish the process.

5. Defragment your hard disk.

https://www.wikihow.com/Optimize-Your-PC-Performance

Regularly defragmenting your hard drive organizes the files in your computer, creating more space in the drive. Disk Defragmenter is a great built-in tool, designed for this purpose.

1. Click the Start button.
2. In the Search box, type Disk Defragmenter.
3. Click Disk Defragmenter.
4. Under Current status, select the disk you wish to defragment.
5. Click Analyze disk. This will let you know if you need to defragment that particular disk.
6. After Windows is done analyzing the disk, it shows you the percentage of fragmentation on the disk. If that number is above 10 percent, you should defragment the disk.

6. Run fewer programs at a given time.

https://www.wikihow.com/Optimize-Your-PC-Performance
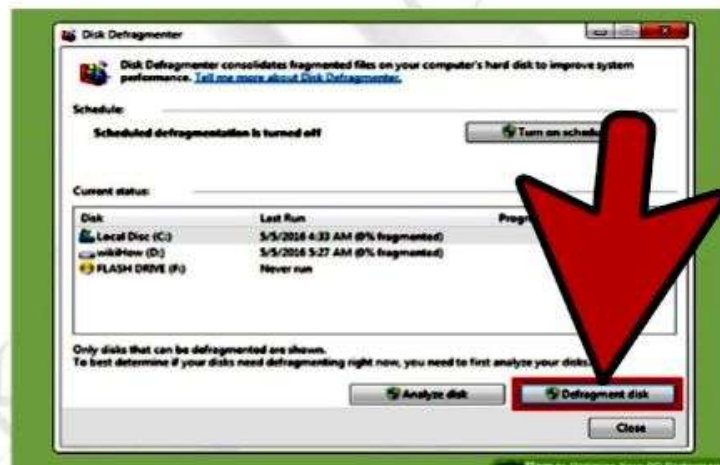
Keeping too many programs open at the same time can bring down your PC's performance. Try to work with fewer programs at the same time.

1. Press Ctrl+Shift+Esc to open the Task Manager.
2. Click Processes. This will let you see the list of processes running on your PC.
3. Scroll down to view the entire list of programs.
4. Check the name and description of each program to identify it.
5. Check the Memory column to see how much memory is being consumed by each process.
6. Right-click on any active process and choose "End process". This will close the program.

7. Run only one antivirus program.

https://www.wikihow.com/Optimize-Your-PC-Performance
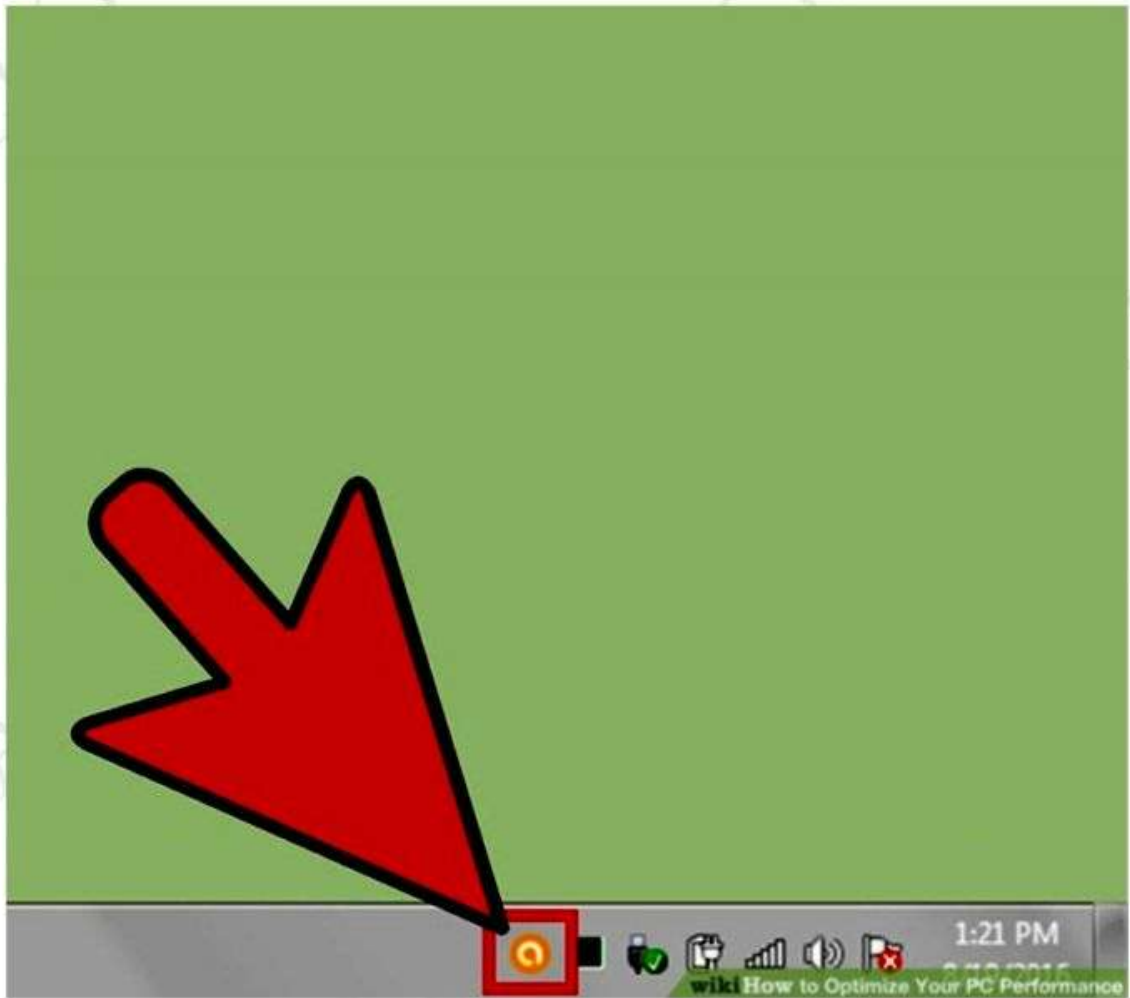
Running two or more antivirus programs could slow down your computer over a period of time.

- The Windows Action Center usually notify you if you are running more than one antivirus program.

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8. Regularly restart your PC.

https://www.wikihow.com/Optimize-Your-PC-Performance

Restart your computer at least once a week. This helps clear memory and properly shuts down all programs running in the background; with or without your knowledge.

End of chapter Questions

1. List four examples of utility software. [4 marks]
2. Mr Bhayela Enterprises decided to build their own software for stock control. Outline justifications which made them to reach this decision. [5 marks]
3. Other than being cheap, what are the other benefits that are brought by acquiring an off-the-shelf software? [4 marks]
4. Differentiate between off-the-shelf software and tailor-made software. [2 marks]

Chapter 2
Application of computer science

In this chapter you will learn about
- Areas of computer applications

Introduction

Today computers play an important role in our life. Many works in our daily life are done through computers.

Computers in Agriculture

The arrival of computers in the world of farming made life easier for farmers in a number of ways.

Record keeping

Computers are used for keeping records such as budget information,farm equipment inventories and animal health forms.Like many small business owners, farmers also use basic computer programs for this like Ms Excel, Ms word etc. Ready-made computer applications are available
- to track individual animals
- to storing and evaluating information such as age
- for health records keeping
- to record milk production,
- to record offspring productivity,
- to record reproductive cycle status.

This is often called herd recording.

Automatic Adjustments

Farm equipment such as tractors, fertilizers sprayers have computers that farmers can program to automatically adjust the amount of fertilizers according to the requirements of soil and crops which helps in improving soil and higher crop yield.

Remote control

Farmers can use computer systems to guide the steering on their farm equipment during planting or harvesting; if the system experiences problems, technicians can diagnose and fix the issues remotely from another computer

Example of a computer controlled implement

Planters, put seed in the ground. A planter such as shown below may have

independently controllable row units, enabling each unit to be turned on and off, or have its planting rate adjusted, independently.

How the above planter works
- the prescription map is loaded into the computer on the tractor
- the tractor driver simply drives
- the tractor pulls the planter
- the onboard computer controls the seeding rate based on where the planter is in the field.
- The computer also tracks where seed has already been applied, so if the driver has to drive through already-seeded area it doesn't get double seeded
- The same strategy is applied in other crop maintenance activities such as fertilizing and other chemical applications. The computer monitors the vehicle location and ensures chemicals are applied only where prescribed.

This has cost benefits to the farmer — less chemicals used is dollars saved — and it also has environmental benefits, since less chemicals used is less chemicals at risk of leeching into the surrounding ecosystem.

Robots in Agriculture
Robots are used in agriculture. They remove the human factor from this difficult work. They can be taught to navigate through farmland and harvest crops on their own. Robots can also be used for horticulture needs, such as pruning, weeding, spraying pesticide and monitoring the growth of plants.

Robots have become increasingly important for investigating and researching hazardous and dangerous environments. These robots are capable of entering an active volcano to collect data or a burning building to search for victims.

Computers increase productivity
Farmers get lots of information through internet forums,social networking sites

and online knowledge bases. With these they contact other farmers and experts to exchange information.There are many online databases,articles,newspapers in which there is a lot of information available for farmers which help them in increasing productivity.

Environmental management

Farmers need good environmental conditions in order to yield best results. Therefore, computers play a vital role in assessing the land that farmers need to use. Farmers often use Geographic Information Systems (GIS) for developing ranking systems that evaluate land and provide a site assessment. These hi-tech, interactive systems provide information based on a variety of factors such as

- soil conditions,
- drainage and slope conditions,
- soil pH and nutrient status, etc.

Precision agriculture provides farmers with control by predicting vital information including fertilizer application and problems with drainage, insects, and weeds. Another technology used by farmers is the Global Positioning System (GPS) based technologies that also help

- to monitor irrigation,
- field mapping,
- soil sampling,
- tractor guidance
- crop scouting.

This kind of technology equips farmers with enough information to increase crop yield in a manner that is consistent with the best environmental practices for sustainable agriculture

Computers in transport

Computers are very useful in transportation today. They are useful in land, air and sea transportation.

Global Positioning System

The important use of computers in transportation is Global Positioning System, or GPS. A screen is displayed that shows a map which tracks your vehicle's movement through satellites signals.

Traffic control intersection

Robots are used to control and regulate traffic flow as they have an inbuilt computer system that controls the robot's sequence.

Source: USDOT, 2014
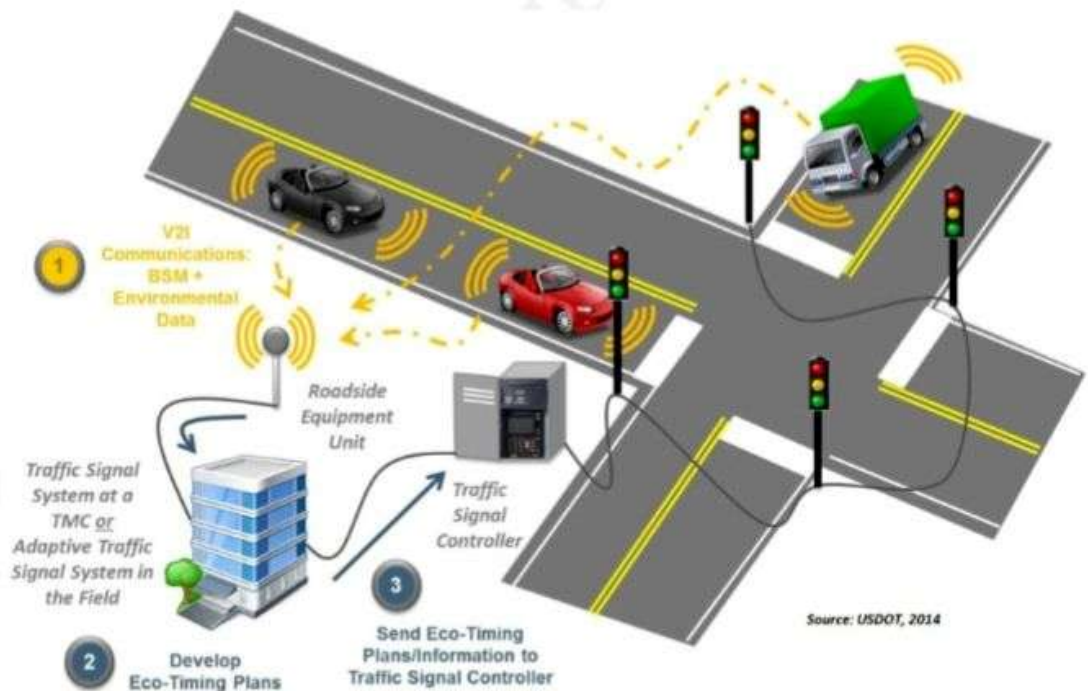
picture: www.nhighwaytravel.blogspot.com

Train control

The computer system that tracks the movement of trains on various railways around the country is called Positive Train Control. PTC technology is capable of preventing train to train collisions, derailments caused by excessive speed and the associated death or injuries.

Map system

Mapping system through computers is very useful nowadays We can find the route of any location where we want to go through this system. We input our address and destination address then the computer will give us a visual map, distance, total driving time, traffic jams etc.
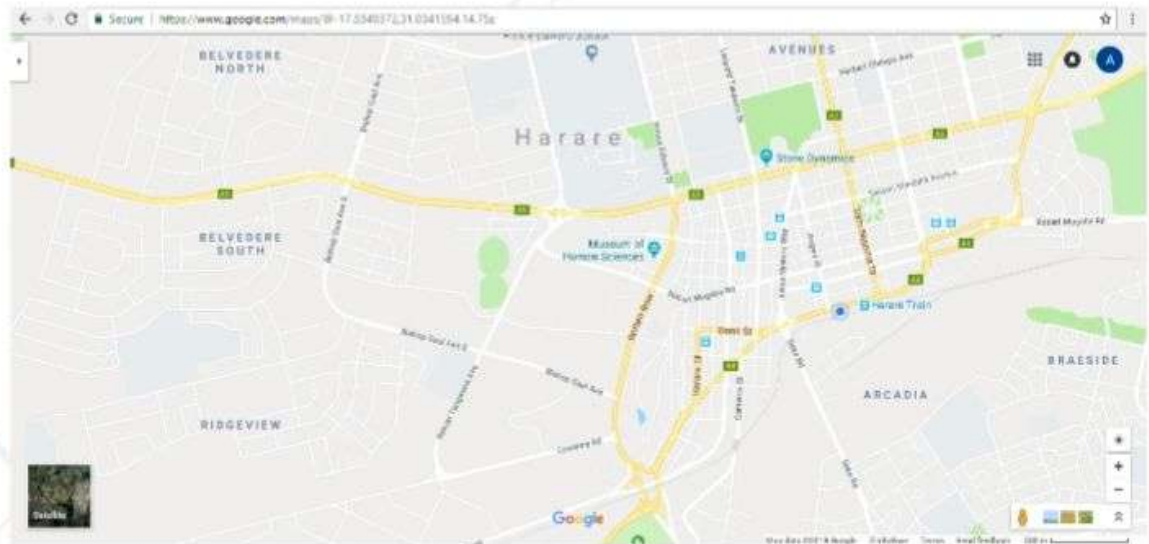
Online booking

Computers have made life much easier for those travelling within and abroad. We can book our tickets for a buses abd, train, airplanes online. Which saves our time. Websites give us all information regarding tickets in few seconds. Computer systems allow us to access these websites and functions at any place and time.
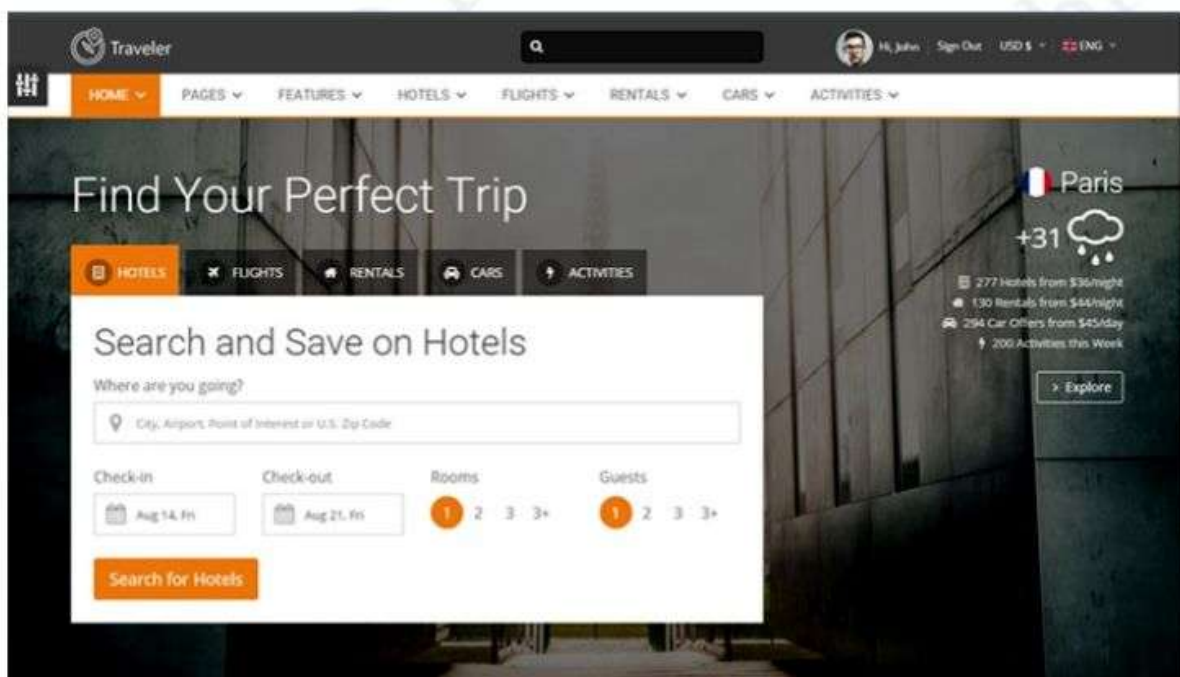
Weather forecast

We can get weather forecast information through computers which is very useful for air and sea transportation. We can travel according to the weather forecast given by computers.

Aircraft Control

The airplane itself has many computer-based systems that provide information to the crew, manage the engines and control other equipment. The airplane has the same GPS that helps you find your way on city streets and also provides navigation data for airplanes. Many aspects of take-off, flight and landing work under the guidance of a computer.

Control system in an aeroplane

Airports

Computers are used at the airport for so different reasons that include:

1. To ensure that planes stay on schedule and that they fly safely.
2. Allows you to easily modify travel arrangements at an airport.
3. Computers are necessary for the pre-screening measures.
4. Computers are crucial to an airport's air traffic control services.
5. Computers are central to the efficient communication and recording of an aircraft's flight data.

Control system at an airport

Ship Navigation

Ships use the GPS called marine radars to detect other ships and land obstacles. It also provides bearing and distance for collision avoidance and navigation at sea.

Computer use in health

Computers help physicians and medical researchers to discover, test and apply medical techniques in virtually every hospital in the world. Furthermore, computer technology provides an infrastructure to allow medical ideas and knowledge to be filed and shared globally with other medical professionals.

X-rays and CT scans

C.T Scanner

(Picture courtesy of Diagnostic Radiology and MRI center Harare)

CT scanning machines are run and monitored by computers.

- X-rays and CT scans use radiation to produce images of a patient's internal structure to search for abnormalities. X-rays allow for viewing of the internal structure of the patient from one perspective.
- CT scanning on the other hand uses computer technology to take several X-ray images that are two-dimensional cross-sections and turn them into a multidimensional picture that doctors use to make a diagnosis. These single X-rays are combined using computer programs that reconstruct the internal structure of the patient.

Magnetic Resonance Imaging

Magnetic Resonance Imagining

(Picture courtesy of Diagnostic Radiology and MRI center Harare)

MRI scans

- Magnetic Resonance Imaging, more commonly known as MRI, is the process of using powerful magnetic fields to map the patient's internal structure and activity.
- MRI is used to produce detailed images of soft tissues in the body without using radiation. The bio-electrical activity in the body is detected by the MRI machine and fed to a computer that interprets the structure of the area being scanned and presents a three-dimensional presentation of electrical activity in the region. This allows doctors to search for physical and operational defects in patients.

Spectroscopy

Spectroscopy is the study of the interaction of electromagnetic radiation with substance, such as biopsy tissue or suspected dangerous substances, and examining the reflected or transmitted radiation patterns. The reflected or transmitted radiation is analyzed by a computer that determines which wavelengths are present or missing. This pattern, called a spectrum, is then compared to a database of known substances to find a match. This allows doctors to quickly determine if a poisonous substance is involved and decide how to treat the patient.

Patient monitoring
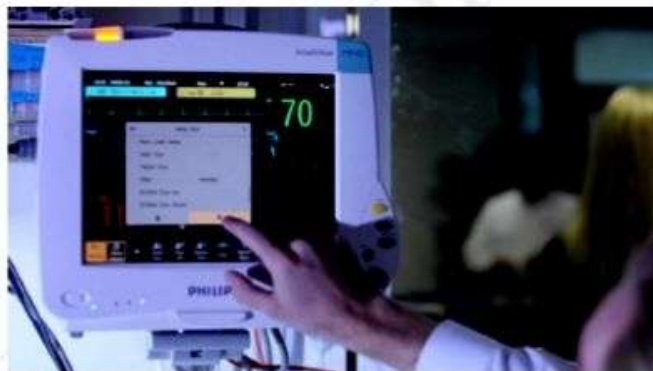
Patients admitted at a hospital are connected to machines that use monitoring software to record blood pressure, pulse, and oxygen levels. The computers are programmed to notify the staff if any of these statistics are recording negatively.

Surgery

Computerised robotics allows doctors to perform surgery on patients without even being in the same room. Video networking and real-time vital statistics monitoring allow safe surgeries that are observed by on-staff doctors or students.

Secure Data Storage

Computer database technology allows medical professionals to maintain thorough patient files secured with encryption routines and even stored off site for extra security and backup capabilities.

Internet Connectivity

Personal computers are used for real-time consults and second opinions. This allows for the diagnosis procedure to take less time, which can equate to increased lad results or a life-saving treatment. Furthermore, the use of small computing devices, such as PDAs and smart phones, allow doctors to perform their work in less technologically areas that do not have landline internet connections

Diagnostic Databases

Computer databases allow doctors to store diagnostic information and make that information searchable. This allow medical information from previous cases to be instantly available to medical professionals at any time.

Medical Research

Medical simulation is used for searching cures of diseases such as cancer, AIDS etc. The computerized software lets millions of computers join together in a manner that increases the speed at which potential cures may be found.

Medical Practice Software

Computer software is used to track all aspect of medical practice. Patients files, profit and loss statements and billing forms are all handled using computer software.

Underwater robots

Underwater robots are used to explore the well site and interact with the problematic equipment. Engineers use remote-operated vehicles (ROVs) that dive to great depths and stay submerged for much longer than any human ever could. ROVs are remote-controlled submarines that are operated by humans sitting in the command center. Police robots help fight crime without risking the lives of police officers.

Robots provide a more effective and efficient cleaning than manual brushes. It's also safer for industrial and institutional markets to use robots because workerswwont be exposed to harmful chemicals or enzymes. Duct cleaning robots are used in hospitals and government buildings that may have hazardous or contaminated environments,

Robots are used in the automobile industry to assist in building cars. These high-powered machines have mechanical arms with tools, wheels and sensors that make them ideal for assembly line jobs. Not only do robots save more money in manufacturing costs, but they also perform tough tasks at a pace no human could possibly do. Robots also make car manufacturing safer because they can take on dangerous and difficult jobs in place of humans.

Military robots are some of the most high-tech and important robots used today. These state-of-the-art machines save lives by performing extremely dangerous tasks without endangering humans

Activity
Educational tour: Visit any hospital which has a medical expert system

End of chapter Questions

1. List any three areas where computers can be used in Agriculture.   [3 marks]

2. Many new cars and taxis have GPS systems and webcams fitted to the dashboards of the vehicle. Data, including the video, is often saved to an SSD.

   a. What is the main reason why taxi driver would use a GPS system? [1 mark]

   b. Give ONE reason why the GPS system should be updated regularly, besides removing bugs and improving the security of the software. [1 mark]

   c. Why would the bus or taxi company install an SSD rather than an HDD (hard disk drive) to save the video and data within the vehicle? [1 mark]

Chapter 3
Data Representation

In this chapter you will learn about:
- Convert numbers from one base to another
- Convert keyboard characters to ASCII code
- Add binary numbers
- Subtract binary numbers

Binary

A number system that contains two digits, 0 and 1. Also known as base 2

Converting denary to binary: Method 1
There are two methods for converting a denary (base 10) number to binary (base 2). This is method one.

Divide by two and use the remainder
Divide the starting number by 2. If it divides evenly, the binary digit is 0. If it does not - if there is a remainder - the binary digit is 1.
A method of converting a denary number to binary

Worked example: Denary number 83

1. $83 \div 2 = 41$ remainder 1
2. $41 \div 2 = 20$ remainder 1
3. $20 \div 2 = 10$ remainder 0
4. $10 \div 2 = 5$ remainder 0
5. $5 \div 2 = 2$ remainder 1
6. $2 \div 2 = 1$ remainder 0
7. $1 \div 2 = 0$ remainder 1

Put the remainders in reverse order to get the final number: 1010011.

64	32	16	8	4	2	1
1	0	1	0	0	1	1

To check that this is right, convert the binary back to denary:
$(1 \times 64) + (0 \times 32) + (1 \times 16) + (0 \times 8) + (0 \times 4) + (1 \times 2) + (1 \times 1) = 83$
Worked example: Denary number 122

1. $122 \div 2 = 61$ remainder 0

2. $61 \div 2 = 30$ remainder 1
3. $30 \div 2 = 15$ remainder 0
4. $15 \div 2 = 7$ remainder 1
5. $7 \div 2 = 3$ remainder 1
6. $3 \div 2 = 1$ remainder 1
7. $1 \div 2 = 0$ remainder 1

Put the remainders in reverse order to get the final number: 1111010.

128	64	32	16	8	4	2	1
0	1	1	1	1	0	1	0

To check that this is right, convert the binary back to denary:
$(1 \times 64) + (1 \times 32) + (1 \times 16) + (1 \times 8) + (0 \times 4) + (1 \times 2) + (0 \times 1) = 122$

NOTE: The binary representation of an even number always ends in 0 and an odd number in 1
Converting denary to binary: Method 2
There are two methods for converting a denary (base 10) number to binary (base 2). This is method two.

Take off the biggest 2n value you can
Remove the 2n numbers from the main number and mark up the equivalent 2n column with a 1. Work through the remainders until you reach zero. When you reach zero, stop and complete the final columns with 0s.
A method of converting a denary number to binary

Worked example: Denary number 84
First set up the columns of base 2 numbers. Then look for the highest 2 numbers that goes into 84.
1. Set up the columns of base 2 numbers
2. Find the highest 2n number that goes into 84. The highest 2n number is 26 = 64
3. $84 - 64 = 20$. Find the highest 2n number that goes into 20. The highest 2n number is 24 = 16
4. $20 - 16 = 4$. Find the highest 2n number that goes into 4. The highest 2n number is 22 = 4
5. $4 - 4 = 0$
6. Mark up the columns of base 2 numbers with a 1 where the number has been the highest 2nnumber, or with a 0:

64	32	16	8	4	2	1
1	0	1	0	1	0	0

Result: 84 in denary is equivalent to 1010100 in binary.

To check that this is right, convert the binary back to denary:
$(1 \times 64) + (0 \times 32) + (1 \times 16) + (0 \times 8) + (1 \times 4) + (0 \times 2) + (0 \times 1) = 84$

Binary Addition and Subtraction

The addition and subtraction of the binary number system are similar to that of the decimal number system. The only difference is that the decimal number system consists the digit from 0-9 and their base is 10 whereas the binary number system consists only two digits (0 and 1) which make their operation easier. The addition and subtraction of binary number systems are explained below in details.

Binary Addition

For understanding the binary addition first consider the addition of two decimal numbers as shown below

```
 3 4
+5 7
```

When we add the one's column of the binary digit (ie 7+4) we get the number which is greater than the base of the decimal number (the base of the number is 10 and the sum of the digit is 11). Now add the tens column of the binary digit whose sum is equal to 9, and hence less than the base. So there is no carry in the ten's column of the binary digit

The solution of the above sum is explained below

```
 3 4
+5 7
 9 1
```

The binary number system uses only two digits 0 and 1 due to which their addition is simple. There are four basic operations for binary addition as mentioned above.
0+0=0
0+1=1
1+0=1
1+1=10

The above first three equations are very identical to the binary digit number. The column by column addition of binary is supplied below. Let us consider the addition of 11101 and 11011.

```
    1 1 1 1  carry
    1 1 1 0 1
  + 1 1 0 1 1
  1 1 1 0 0 0
```

The above sum is carried out by the following step

1+1=10=0 with a carry of 1
1+0+1=10=0 with a carry of 1
1+1+0=10=10 with a carry of 10
1+1+1=10+1=11with a carry of 1
1+1+1=11

Note carefully that 10+1=11, which is equivalent to two+one=three (the next binary number after 10)
Thus the required result is 111000

Adding binary numbers is similar to adding denary numbers.
Example: Adding the binary numbers 11 and 100
Write the numbers out using the column method. Start from the right, and simply add the numbers.

111 is 7 if converted back to denary.

Example: Adding two 1s in the same column
Sometimes a binary addition will require you to carry over values into the next highest place-value column, eg when finding the sum of the binary numbers 0010 and 0111:
There is a clash when adding two ones in the same column. In binary, 1+1 is 10 - it has to become 0 with 1 carried over.

1001 is 9 if converted back to denary. 2 + 7 = 9 in denary.

Binary Subtraction
The subtraction of the binary digit depends on the four basic operations

0-0=0
1-0=1
 1-1=0
10-1=1

The above first three operations are easy to understand as they are identical to decimal subtraction. The fourth operation can be understood with the logic two minus one is one.
For a binary number with two or more digits, the subtraction is carried out column by column as in decimal subtraction. Also, sometimes one has to borrow from the next higher column.

Consider the following example.

```
   0 10    borrow
  1 1 0 0
(-)1 0 1 0
   0 0 1  0
```

The above subtraction is carried out through the following

0-0=0
For 0-1=1, taking borrow 1 and then 10-1=1
For 1-0, since 1 has already been given, it becomes 0-0=0
1-1

Therefore the result is 0010

Converting binary to denary

To calculate a large binary number like 10101000 we need more place values of multiples of 2.

$2^7 = 128$
$2^6 = 64$
$2^5 = 32$
$2^4 = 16$
$2^3 = 8$
$2^2 = 4$
$2^1 = 2$
$2^0 = 1$

In denary the sum is calculated as:

$(1 \times 128) + (0 \times 64) + (1 \times 32) + (0 \times 16) + (1 \times 8) + (0 \times 4) + (0 \times 2) + (0 \times 1) = 128 + 32 + 8 = 168$

Machine converting binary number 10101000 into denary number 168
The table below shows denary numbers down the left with their equivalent binary numbers marked out below the base 2 columns. Each individual column in the table represents a different place value equivalent to the base 2 powers.

A translation table shows how binary map to denary numbers
Adding and Subtracting Binary
Explain how you solve the following addition problem
in decimal notation:

6 4
+ 4 5
1 0 9

Here are the addition facts that you need when adding numbers in binary notation.

Explain these addition facts by converting numbers to decimal notation. The rest one is done for you:

Binary Notation Decimal Notation
* Solution: 0+1=1
* Solution: 1+1=2

1. Explain which of these addition facts will lead to carrying when you are adding bigger numbers. Now explain this problem in binary notation: Solution: The fact that 1 + 1 = 1 0 will lead to carrying since the only digits in binary are 0 and 1.

   1 0
   + 1 1
   1 0 1
   1

2. Solve the following addition problems (be careful as carrying may be involved). Remember to box your solutions! Check your work by solving the problem in decimal notation on the side. Binary Notation Decimal Notation

   a.) Solution: 1 1 1 1 (10 + 5 = 15)
   b.) Solution: 1 1 1 0 1 (15 + 14 = 29)
   2 Now, let's try subtracting. Here again are some standard subtraction facts we know.
   Binary Notation Decimal Notation
   * Solution: 1-1=0
   * Solution: 1-0=1
   * Solution: 2-1=1

3. Explain which of these subtraction facts will lead to borrowing when you are subtracting bigger numbers. (Hint: think about why you have to borrow in decimal notation!) Now explain this problem in binary notation:
   Solution: The fact that 1 0 - 1 = 1 will lead to borrowing since you cannot take 1 from 0 for a certain place value, and so you must borrow from the 1 in the next place value, much like how you need to borrow in decimal notation.

   1 0 0
   - 1 0
   1 0
   3

   4. Subtract the following binary numbers:
   Binary Notation Decimal Notation
   a.) Solution: 1 1 0 (15 - 9 = 6)
   b) Solution: 1 1 (9 - 6 = 3)

4 Counting Binary Numbers with your Fingers!. Last week, we learned to count to 31 with your fingers of your left hand. For the pictures of different hand positions

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below, write down the numbers they represent in binary notation and decimal notation.

Remember that the pinky finger is the highest digit (16) and the thumb is the lowest digit (1).

a. b.

Solution: 3 Solution: 14

c. d.

Solution: 2 Solution: 17

Back to binary adding! Solve the following addition problems. Remember to box your solutions.

6.

Solution: 1 1 1 1 1 (17+9+5= 31)

7.

Solution: 1 0 0 0 0 0 (21+10+1=32)

There are two reasons to use ASCII. First, we need some way to represent characters as binary numbers (or, equivalently, as bit string patterns). There's not much choice about this since computers represent everything in binary.

If you've noticed a common theme, it's that we need representation schemes for everything. However, most importantly, we need representations for numbers and characters. Once you have that (and perhaps pointers), you can build up everything you need.

The other reason we use ASCII is because of the letter "S" in ASCII, which stands for "standard". Standards are good because they allow for common formats that everyone can agree on.

Unfortunately, there's also the letter "A", which stands for American. ASCII is clearly biased for the English language character set. Other languages may have their own character set, even though English dominates most of the computing world (at least, programming and software).

Also note that there are only 128 ASCII characters. This means only 7 bits are required to represent an ASCII character. However, since the smallest size representation on most computers is a byte, a byte is used to store an ASCII character. The MSb of an ASCII character is 0.

Sometimes ASCII has been extended by using the MSb.

Note. The small letters are all represented in hex.

Okay, so with that out of the way, now we just need to know what letters are

Code	Character	Code	Character	Code	Character	Code	Character
0	(null)	64	@	128	Ç	192	À
1	☺	65	A	129	Ü	193	Á
2	●	66	B	130	É	194	┬
3	♥	67	C	131	Â	195	├
4	♦	68	D	132	Ä	196	─
5	♣	69	E	133	À	197	┼
6	♠	70	F	134	Å	198	╞
7	•	71	G	135	Ç	199	╟
8	◻	72	H	136	Ê	200	╚
9	(tab)	73	I	137	Ë	201	╔
10	■	74	J	138	È	202	╩
11	(home)	75	K	139	Ï	203	╦
12	(form feed)	76	L	140	Î	204	╠
13	(carr. return)	77	M	141	Ì	205	═
14	♫	78	N	142	Ä	206	╬
15	☼	79	O	143	Å	207	╧
16	►	80	P	144	É	208	╨
17	◄	81	Q	145	Æ	209	╤
18	↕	82	R	146	Æ	210	╥
19	‼	83	S	147	Ô	211	╙
20	¶	84	T	148	Ö	212	╘
21	§	85	U	149	Ò	213	╒
22	▬	86	V	150	Û	214	╓
23	↨	87	W	151	Ù	215	╫
24	(cancel)	88	X	152	ú	216	╪
25	(end medium	89	Y	153	Ö	217	■
26	→	90	Z	154	Ü	218	┌
27	←	91	[	155	¢	219	■
28	∟	92	\	156	£	220	▬
29	↔	93	]	157	¥	221	▌
30	▲	94	^	158	Pts	222	▐
31	31	95	_	159	ƒ	223	▬
32	(Space)	96	`	160	Á	224	à
33	!	97	a	161	Í	225	ß
34	"	98	b	162	Ó	226	â
35	#	99	c	163	Ú	227	ã
36	$	100	d	164	Ñ	228	Σ

37	%	101	e	165	Ñ	229	σ
38	&	102	f	166	a	230	µ
39	'	103	g	167	º	231	τ
40	(	104	h	168	¿	232	Φ
41	)	105	i	169	⌐	233	Θ
42	*	106	j	170	¬	234	Ω
43	+	107	k	171	½	235	δ
44	,	108	l	172	¼	236	∞
45	-	109	m	173	¡	237	φ
46	.	110	n	174	«	238	ε
47	/	111	o	175	»	239	∩
48	0	112	p	176	°	240	≡
49	1	113	q	177	±	241	±
50	2	114	r	178	²	242	ò
51	3	115	s	179	³	243	ó
52	4	116	t	180	´	244	ô
53	5	117	u	181	µ	245	⌡
54	6	118	v	182	¶	246	÷
55	7	119	w	183	·	247	≈
56	8	120	x	184	‚	248	°
57	9	121	y	185	¹	249	·
58	:	122	z	186	º	250	·
59	;	123	{	187	»	251	√
60	<	124			188	¼	252	ⁿ
61	=	125	}	189	½	253	²
62	>	126	~	190	¾	254	■
63	?	127	□	191	¿	255	(blank)

represented by what number. Here's a quick reference for you:

A = 65
B = 66
C = 67
...
X = 88
Y = 89
Z = 90

There is a standard listing called the "ASCII Character Set," in which every character used on a computer's keyboard is assigned a number. There are a lot of these characters, because there isn't just one for every key on your keyboard - there's also one for each key with the SHIFT key pressed. The ASCII character set has room for

256 characters, numbered from 0 to 255.

You might wonder, "Why 256?" and the answer is, because 256 = 28, which means anything less than 256 can be written as 8 binary bits (place values) Each character needs to have the same number of binary bits - otherwise nobody would know where one character ends and the next one starts. So even though the number 15 only needs four bits to be written in binary (1111two) in order to make sure all the numbers have the same length, the computer would write it as 0000 1111two. We put a space between every four digits, for the same reason that we do commas in base ten - it helps us read long strings of digits more easily

Now, there are a couple things you might have wondered about, like "What comes before 65?" and "Why is there a gap between the upper and lowercase numbers?"

The answer to the first question is, there are other characters in those gaps - numbers, punctuation, special control characters (like the Backspace, Enter, Delete, etc).

The reason there's a gap between the upper case and lowercase alphabets is that it makes "a" 32 more than "A." That is very convenient because 32 is a power of 2 (25), so changing between upper and lower case means changing just one bit:

A = 0100 0001
a = 0110 0001

So if you're using the computer's ASCII character set, and you wanted to convert "Hello" into binary, you would look up each letter in the ASCII chart:

H = 72 = 0100 1000two
e = 101 = 0110 0101two
l = 108 = 0110 1100two
l = 108 = 0110 1100two
o = 111 = 0110 1111two

So the entire word "Hello" is:

0100 1000 0110 0101 0110 1100 0110 1100 0110 1111two.

BUT...you don't have to use the ASCII conversion; you could create your own way of converting letters to numbers. Why would you want to do that? Well, you probably wouldn't, unless you wanted to conserve space, and you didn't care about anything except the basic uppercase alphabet.

You see, if all you cared about was the uppercase letters (and maybe a space), then you could do a conversion like this:

SPACE = 0
A = 1
B = 2
C = 3

...
X = 24
Y = 25
Z = 26

Why would you want to do that? Because now the biggest number you need to encode is 26, which is less than 25. That means that you only need five digits to write each number instead of eight! So your encoded message will take up 5/8 as much space. You'll save about 38% of the space on the page.

Since you have to have space in your table for 32 characters, and you've only used up to 26, you might as well use the other ones. Maybe include some punctuation?

COMMA = 27
PERIOD = 28
QUESTION MARK = 29
DASH = 30
DOLLAR SIGN = 31

Or you could create a table with 64 characters, which would either let you put in a lot more punctuation, or the numbers, or the lowercase alphabet. But now you're using six binary digits per character, so you're not saving as much space.

Or you could completely jumble your character chart, which makes it harder for other people to decode:

A = 17
B = 3
C = 25
etc...

But if you really want to make a coded message, there are much better ways to do it, so everyone just sticks with the standard ASCII codes in order to keep things simple.

Task
In pairs discuss how to subtract binary numbers.

End of chapter question

Introducing binary

1. Computers process information as what kind of numbers?
   a) Binary
   b) Denary
   c) Analogue

2. How many bits are there in a nibble?
   a) 2 bits
   b) 8 bits
   c) 4 bits

3. How many unique binary values would be available in an 8-bit image?
   a) 128
   b) 256
   c) 64

4. What is the smallest unit of data that can be represented inside the computer?
   a) One byte
   b) One bit
   c) One nibble

5. What is machine code?
   a) Code that triggers actions in the CPU
   b) Code that encrypts programs to keep them secure
   c) Code written using a high-level programming language

6. With binary numbers, place values are always a power of what?
   a) 16
   b) 10
   c) 2

7. How many binary numbers would be available in a 4-bit system?
   a) 2
   b) 16
   c) 4

8. What number does an even number end in when it is represented in binary?
   a) It always ends in zero
   b) It always ends in one
   c) Either zero or one

Converting binary to denary questions

1. Binary to decimal
   1) 11001011
   2) 00110101
   3) 10000011
   4) 10001111
   5) 11100011
   6) 00000100
   7) 00010010
   8) 00111111
   9) 10101010
   10) 10.01010101

2. Decimal to binary
   1) 213
   2) 9
   3) 67
   4) 99
   5) 23
   6) 143
   7) 6
   8) 1
   9) 197
   10) 10.252

3. Binary to hex
   1) 11001100
   2) 11110001
   3) 00110001
   4) 11000010
   5) 10100100
   6) 10100111
   7) 11101100
   8) 11111100
   9) 00111111
   10) 10.00000011

4. Hex to binary
   1. 0x45
   2. 0xFA
   3. 0x5D
   4. 0x99
   5. 0x03
   6. 0x6B

7. 0xDD
8. 0xFE
9. 0x22
10. 10.0x18

5. Decimal to hex
11. 233
12. 21
13. 9
14. 75
15. 188
16. 56
17. 4
18. 121
19. 94
20. 10.201

Hex to decimal
21. 0x5A
22. 0xCC
23. 0x97
24. 0x40
25. 0x07
26. 0x3D
27. 0xF1
28. 0xFB
29. 0x8210.
30. 0xE4

Chapter 4
Communication Networks and Internet Technologies

In this chapter you will learn about:
- Data transmission modes
- Data Transmission Media
- Types of networks
- Internet Service Providers (ISPs)

Data Transmission modes

Data communications means the exchange of data between two devices via some form of transmission medium such as a wire cable.

For data communications to occur, the communicating devices must be part of a communication system made up of a combination of hardware (physical equipment) and software

Network devices use three transmission modes (methods) to exchange data, or "talk" to each other, as follows: simplex, half duplex, and full duplex.

```
                    ┌─────────────────────┐
                    │  Transmission Mode  │
                    └─────────────────────┘
                              │
         ┌────────────────────┼────────────────────┐
    ┌─────────┐         ┌─────────────┐       ┌─────────────┐
    │ Simplex │         │ Half Duplex │       │ Full Duplex │
    └─────────┘         └─────────────┘       └─────────────┘
```
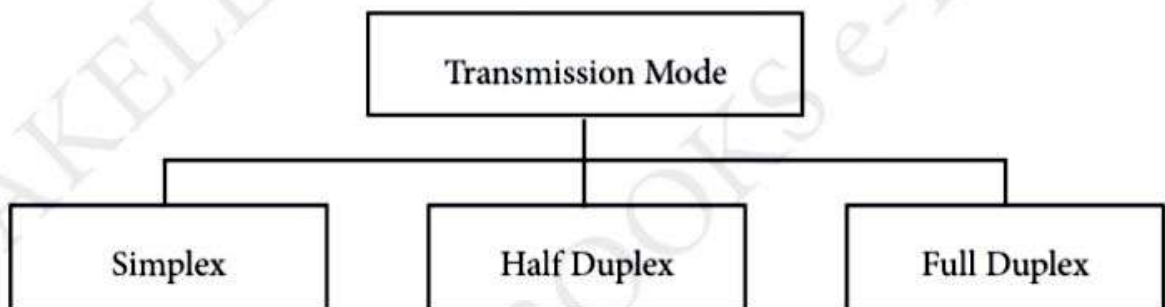
- Simplex transmission is like a one-way street where traffic moves in only one direction. Simplex mode is a one-way-only transmission, which means that data can flow only in one direction from the sending device to the receiving device. Figure 1-7 illustrates simplex transmission.

Simplex
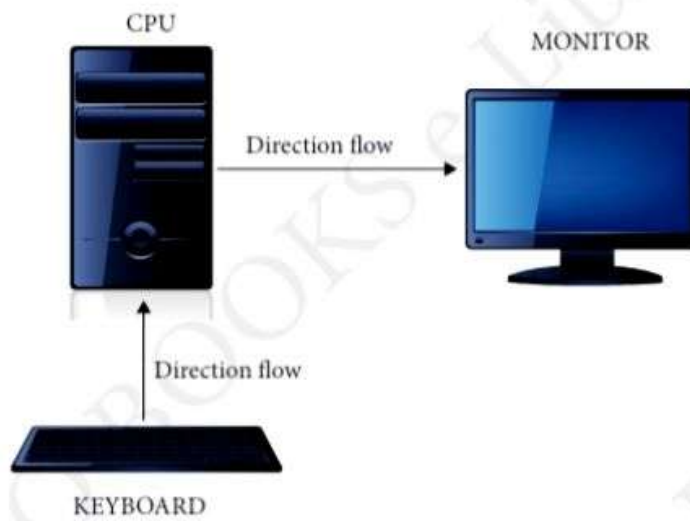
- Half-duplex transmission is like the center lane on some three-lane roads. It is a single lane in which traffic can move in one direction or the other, but not in both directions at the same time. Half-duplex mode limits data transmission because each device must take turns using the line. Therefore, data can flow from A to B and from B to A, but not at the same time. Figure 1-8 illustrates half-duplex transmission.

Half Duplex
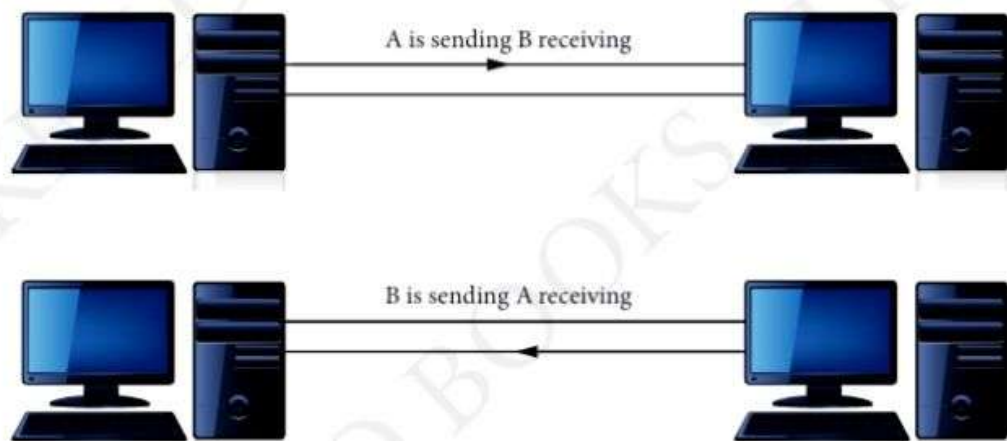
- Full-duplex transmission is like a major highway with two lanes of traffic, each lane accommodating traffic going in opposite directions. Full-duplex mode accommodates two-way simultaneous transmission, which means that both sides can send and receive at the same time. In full-duplex mode, data can flow from A to B and B to A at the same time. Figure 1-9 illustrates full-duplex transmission.

Full Duplex

Full Duplex

Both direction at
the same time
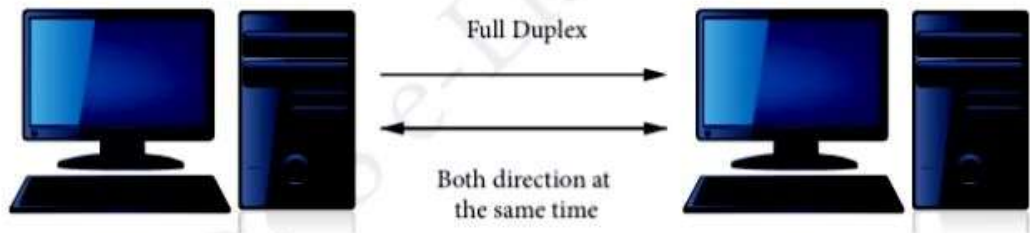
Note

Full-duplex transmission is, in fact, two simplex connections: One connection has traffic flowing in only one direction; the other connection has traffic flowing in the opposite direction of the first connection.

Data transmission media

Transmission media

In data communication, a transmission medium is a physical path between the transmitter and the receiver i.e it is the channel through which data is sent from one place to another. Broadly there are two types of transmission media :

1. Guided media
2. Unguided media
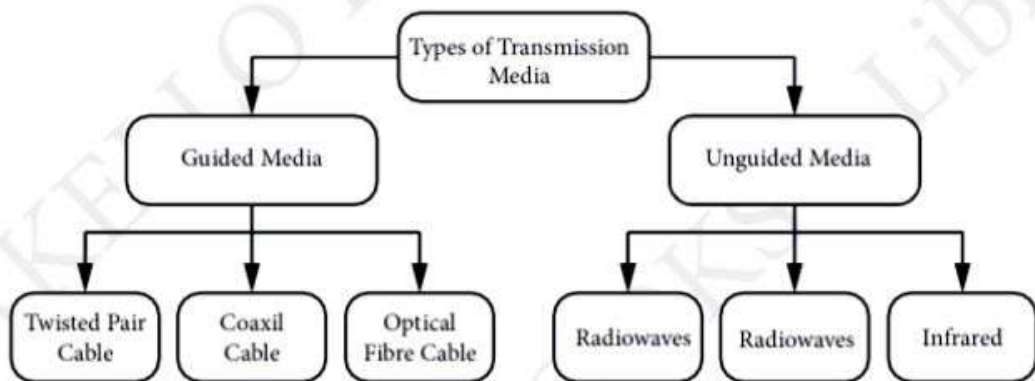
Guided Media

It is also referred to as Wired or Bounded transmission media. Signals being transmitted are directed and confined in a narrow pathway by using physical links.

Features:

- High Speed
- Secure
- Used for comparatively shorter distances

There are 3 major types of Guided Media:

1. Twisted Pair Cable
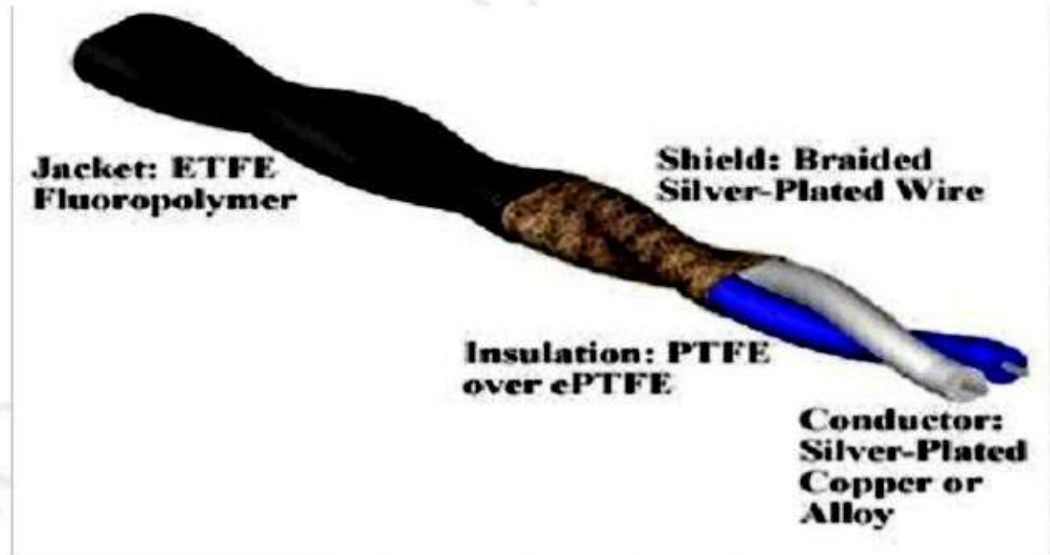
It consists of 2 separately insulated conductor wires wound about each other. Generally, several such pairs are bundled together in a protective sheath to protect them from electromagnetic interference. They are the most widely used Transmission Media. Twisted Pair is of two types: They can either be shielded (STP) which has an extra layer of insulation to prevent interference or unshielded (UTP) without the extra layer.

i). Unshielded Twisted Pair (UTP):
This type of cable has the ability to block interference and does not depend on a physical shield for this purpose. It is used for telephonic applications.
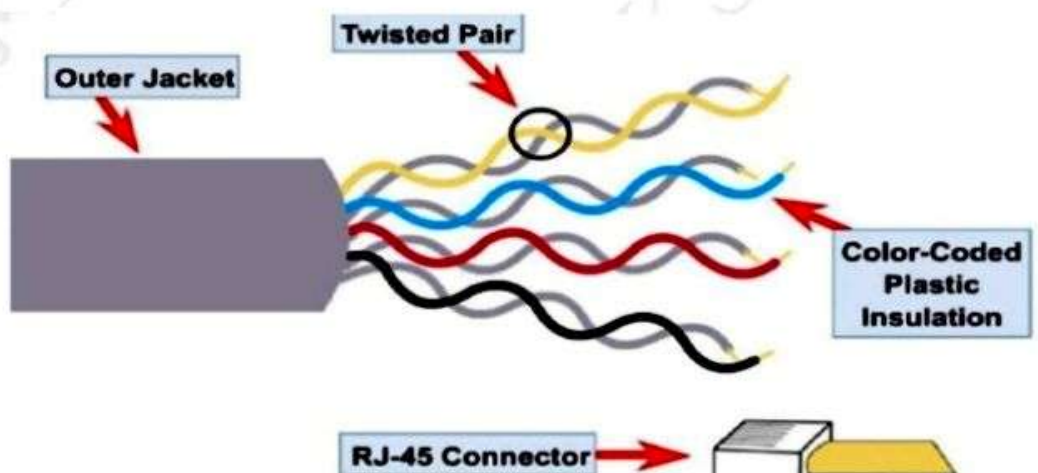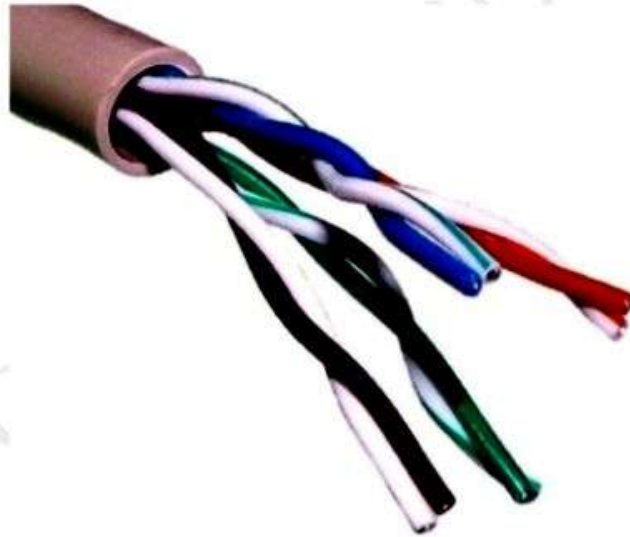
Advantages:
- Least expensive
- Easy to install
- High speed capacity

Disadvantages:
- Susceptible to external interference
- Lower capacity and performance in comparison to STP
- Short distance transmission due to attenuation

ii). Shielded Twisted Pair (STP):

This type of cable consists of a special jacket to block external interference. It is used in fast-data-rate Ethernet and in voice and data channels of telephone lines.
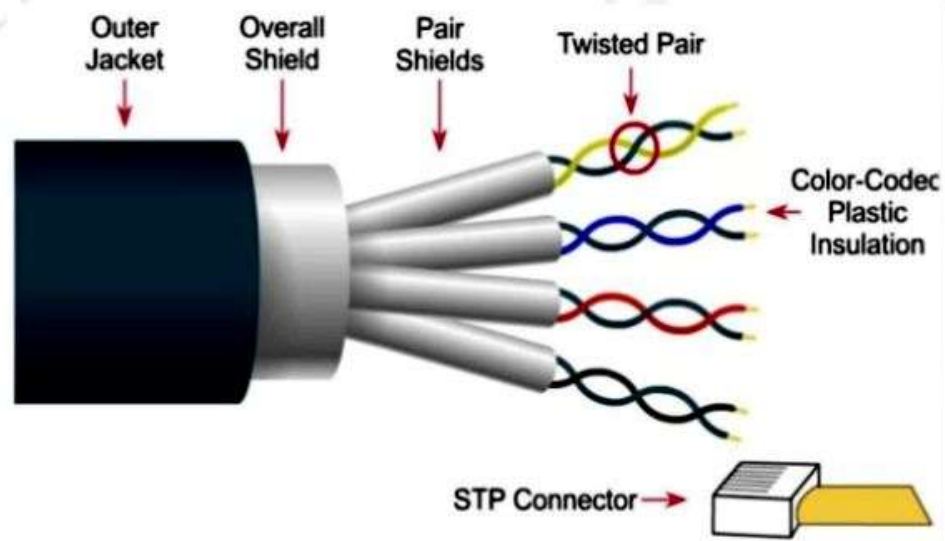
Advantages:
- Better performance at a higher data rate in comparison to UTP
- Eliminates crosstalk
- Comparitively faster

Disadvantages:
- Comparitively difficult to install and manufacture
- More expensive
- Bulky

2. Coaxial Cable

- It has a single copper wire at its core.
- This is then surrounded by a plastic insulation casing and a further layer of braided copper insulation.
- Finally, there is a plastic jacket to offer further protection.
- It is priced between twisted pair and fibre optic,
- Cable TVs and analog television networks widely use Coaxial cables.
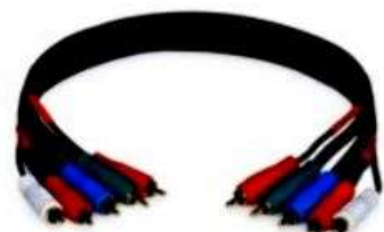
Advantages:

- High Bandwidth
- Better noise Immunity
- Easy to install and expand
- Inexpensive

Disadvantages:

- Single cable failure can disrupt the entire network

Fibre Optic Cable

a). Core – a glass or plastic fibre. Is where the signals are sent through.

b). Cladding – glass or plastic coating with a different composition to that of the core.

c). Jacket – is the outer protective layer, usually made of plastic material, designed to protect the core and the cladding

https://www.studytonight.com/computer-networks/bounded-transmission-media
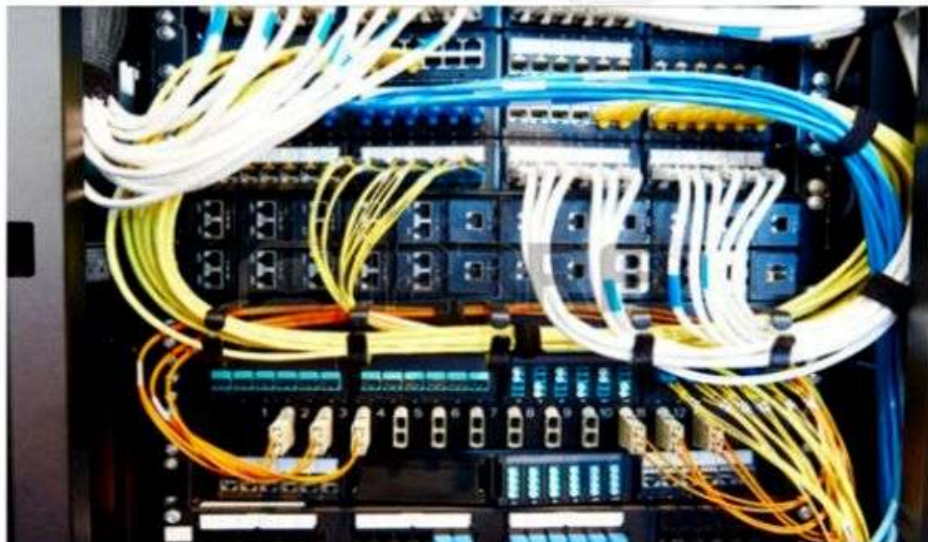
Advantages:
- Increased capacity and bandwidth
- Light weight
- Less signal attenuation

Disadvantages:
- Difficult to install and maintain
- High cost
- Fragile

Unguided (Wireless) Media

It is also referred to as Wireless or Unbounded transmission media. No physical medium is required for the transmission of electromagnetic signals.

Features
- Signal is broadcast through air
- Less Secure
- Used for larger distances

There are 3 major types of Unguided (Wireless) Media:
The three main types of wireless media are:
- Radio waves
- Microwaves
- Infrared waves

1. Radiowaves

They use radio-waves to send frequencies to send data directly between transmitters and receivers. They are easy to generate and can penetrate through buildings. They can travel long distances. They are omnidirectional, meaning that they travel in all directions from the source so the sending and receiving antennas need not be carefully aligned. Frequency Range: 3KHz – 1GHz. AM and FM radios and cordless phones use Radiowaves for transmission.

Radio Wave

Tunning frequency
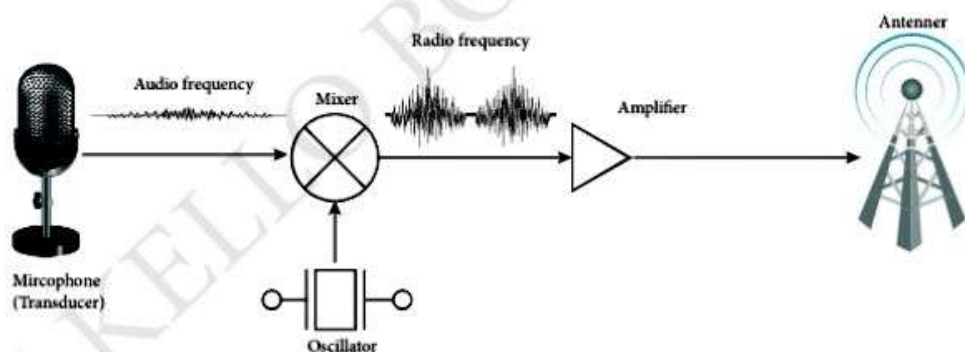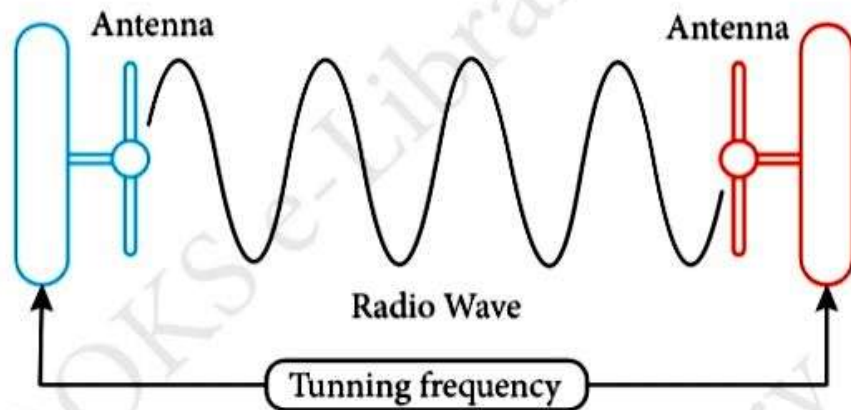
Further Categorized as:
(i) Terrestrial and
(ii) Satellite.

Applications

1. Television and radio transmission
2. Air navigation
3. Long-haul telephone transmission
4. Global Positioning Systems (GPS)
5. Video conferencing and multimedia applications
6. Virtual Private Networks (VPN)
7. Very Small Aperture Terminal System (VSAT)

Advantages

- Signals can travel through objects
- Require inexpensive devices
- Support high speed data transmission

Disadvantages

- Possible electrical interference problems
- Signal can be interrupted by anyone with similar equipment using the same frequency.

2. Microwaves

It is a line of sight transmission i.e. the sending and receiving antennas need to be properly aligned with each other. The distance covered by the signal is directly proportional to the height of the antenna. Frequency Range:1GHz – 300GHz. These are majorly used for mobile phone communication and television distribution.

End Station   Relay Station   End Station
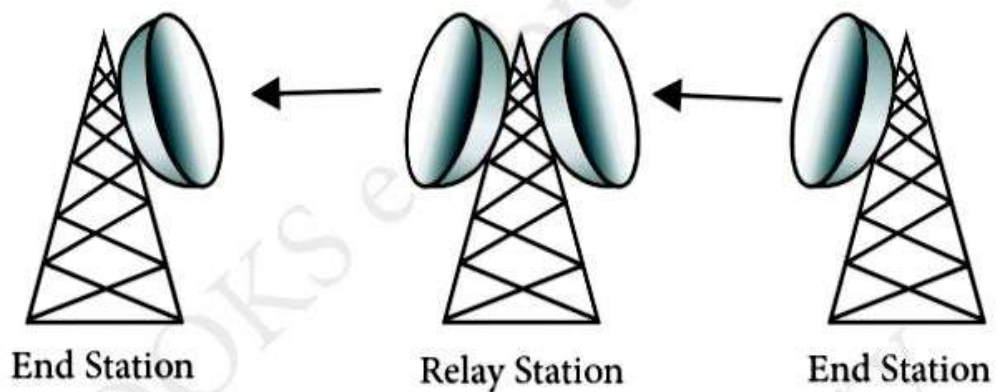
Advantages of Satellite Microwave

- Transmitting station can receive back its own transmission and check whether the satellite has transmitted information correctly.
- A single microwave relay station which is visible from any point.

Disadvantages of Satellite Microwave

- Satellite manufacturing cost is very high
- Cost of launching satellite is very expensive
- Transmission highly depends on weather conditions, it can go down in bad weather

1. Infrared

Infrared waves are used for very short distance communication. They cannot penetrate through obstacles. This prevents interference between systems. Frequency Range:300GHz – 400THz. It is used in TV remotes, wireless mouse, keyboard, printer, etc

earth
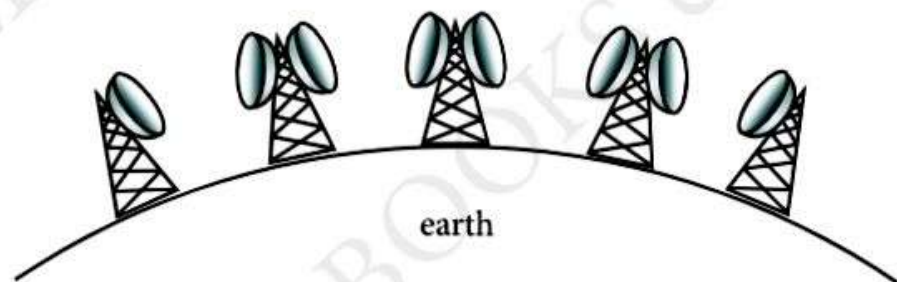
Advantages

- Lower power requirements therefore ideal for laptops, telephones, personal digital assistant (PDA)
- Low circuitry costs:
- Simple circuitry.
- Higher security
- Portable

Disadvantages

- It needs a direct line of sight between the transmitter and receiver. For exam-

ple, it doesn't work through walls and doors.
- Transmission can be blocked by common material: People, walls, plants, etc.
- Perfomance drops off with longer distances
- Sensitive to direct light and weather.
- Data rate transmission is lower than typical wired transmission

Activity
Give your own example of how the different types of transmission mediums
can affect the performance of a network

Connection devices

Hub
- It is a device for connecting a number of terminals to a network connection in a 'star' configuration.
- They can be used in connection with each other.

Bridge
- Is a device that connects two different LANs.
- The incoming data from one LAN is stored in a buffer memory and then, when the second LAN is ready to receive it, the data is communicated.
- For it to work effectively the two LANs must be on the same platform but the buffer means they can be running at different speeds.

Gateway
- Is a device that enables LANs to communicate with WANs. LANs may be operating on different, incompatible platforms.
- They use conversion software to ensure that data transmission protocols are compatible and that dissimilar LANs can connect to WANs.

Router
- Is a device which helps to determine the optimum route for a packet of data across a network.
- Has been helpful to the development of the internet.

Computer networks

Def: it describes any situation in which two or more computers are linked together via some form of communications medium for the purpose of exchanging data or sharing resources.

Stand-alone computer – is a computer that is not connected to any other computer. The reason for using the word devices is because this interconnection is not only limited to computers but a number of different devices like processors and main

servers.

Advantages of Networks
- Sharing of resources, e.g. software, printers, information, etc
- Provision of local facilities without the loss of central control
- Example: the system administrator can perform other tasks, i.e. can work independently.
- The provision of even distribution of work for processing loads.
- Example: provision for improved communication facilities.
- Messages can be sent between users on the same site with LANs, or anywhere in the world with WANs.
- All users can access the same files, so this avoids having to duplicate information.
- Network software can be purchased, which is often cheaper than buying an individual package for each machine.
- It is possible to access data or programs from any terminal/workstation
- Data and software can be stored centrally, which makes them easier to maintain and backup.
- Users can easily be prevented from accessing those files that are not needed for their job.

Disadvantages of Networks
- If a WAN is used, sophisticated equipment is needed and the rental of telecommunication links makes it very expensive.
- A loss in the ability to transmit data for even a short time can cause havoc, with tasks having to be performed manually.
- File security is more important with networks, especially if they connected to the public telephone system.
- Example: if a virus were to get onto a network, it could affect all the networked terminals.
- Wiring can be expensive, both to buy and to install.
- In a type of network called a file server network all the programs and data are stored on a main computer called a server.
- If the server fails/ breaks down, the whole network becomes unusable.
- Networks are temperamental: they need an experienced person (a network manager) to keep them running successfully.

Basically we have four types of networks: these are Personal Area Network, Local Area Networks, Wide Area Networks and Metropolitan Area Networks.

Personal Area Network

A Personal Area Network (PAN) is the smallest network which is very personal to a user. This may include Bluetooth enabled devices or infra-red enabled devices. PAN has connectivity range up to 10 meters. PAN may include wireless computer

keyboard and mouse, Bluetooth enabled headphones, wireless printers, and TV remotes.

Local Area networks
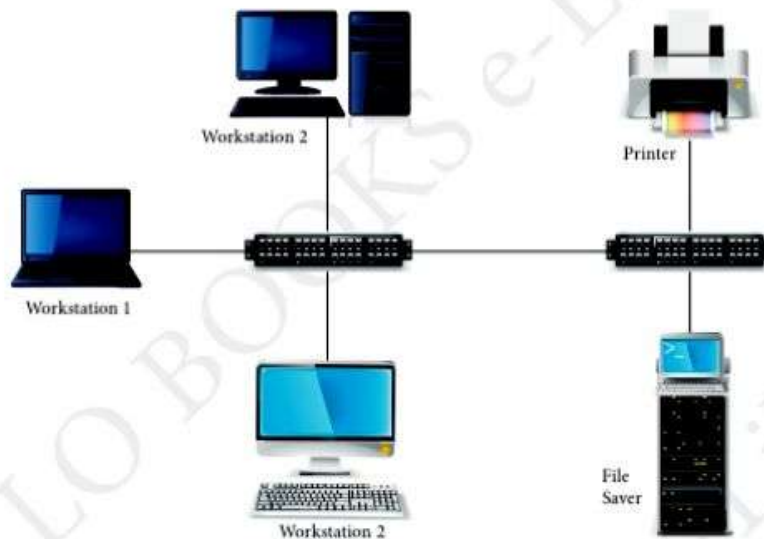
- This is the interconnection of devices and other terminals distributed in a small geographical area that spans a building or a university campus.
- The predominant mode of communication is physical cabling, usually a combination of fibre optic and copper cabling.
- Although there is growing use of wireless devices in LANs.
- All of the network resources are owned and managed by the organisation that uses them.

Advantages
- They share data and resources
- They transmit data to and from each other
- They can access other computer systems, such as, mainframes or networks

Metropolitan Area Network (MAN)

- It is larger than a LAN, its so called because that it normally covers the area of a city.
- They are often used to interconnect LANs that are spread around.

Wide Area Network

- It is a network that spreads across a large geographical area, connecting LANs via a wide range of communications media.
- In addition to physical cabling, wireless and satellite technologies maybe used to complete a network that may be literally world-wide.
- Working in a WAN environment involves using network resources owned and managed by a wide range of organisations.
- They can be further sub-divided into public WANs (the internet is in effect, a public WAN)and private WANs

Network topology

Def: this is the layout of devices in a network.

Star topology
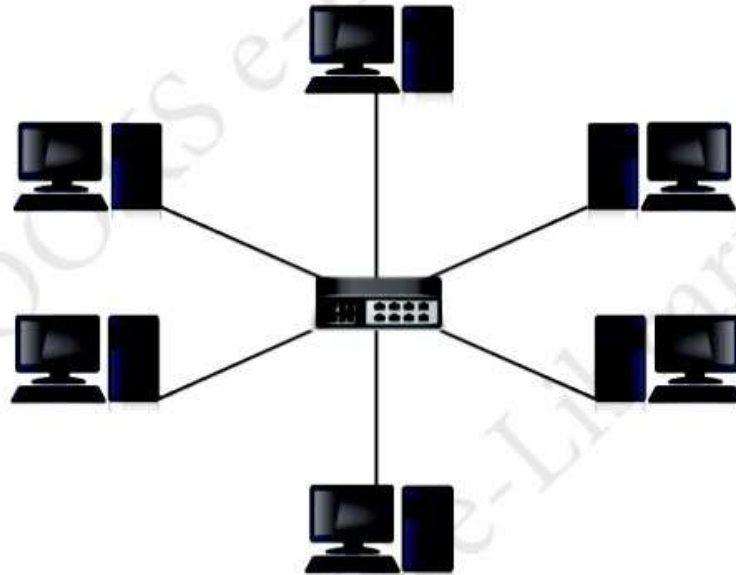
- There is a central computer called a hub that connects all the nodes of the network.
- All data communications between workstations/servers/printers go through this central hub.

Advantages
- Full utilisation of resources
- Because each is independent of the others, if one breaks down, the others continue to function.
- Different workstations may need to send different volumes of data across a network.

The star set up allows for different capacity communication links to be established, related to the different needs of the workstations.

Disadvantages
- There is a good deal of dependency on the hub. If this component fails, the whole system may be out of action.
- Both the hardware and software required for the effective running of a star network are expensive to set up.

Bus Topology
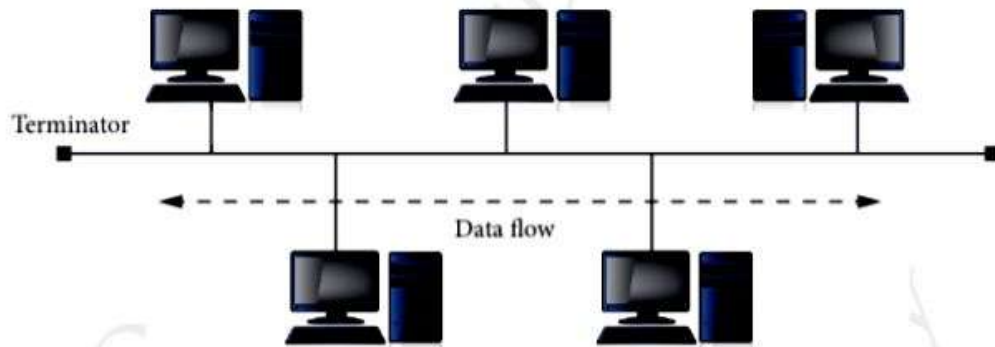
- In a bus topology, the different nodes are all connected to a single communication path.
- Data is transmitted in any direction along a central cable.
- Workstations can communicate with each other.

Advantages
- Compared to other topologies, a bus network is the least expensive and the easiest to set up.
- If one workstation malfunctions, it does not affect the rest of the network.
- It is easy to install additional devices.

Disadvantages
- The system is dependent on the correct functioning of the main cables.
- If this malfunctions, the whole network will go down.
- If the cable does fail, the point of failure is difficult to isolate.
- The performance of the network will be detrimentally affected by heavy data traffic.

Ring Topology
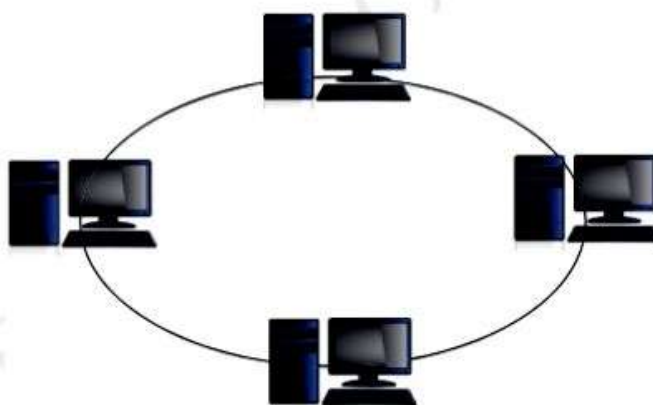
- Is usually a collection of workstations and peripheral devices linked together in a circular configuration.

- There is no central host computer in a ring network, though one node may control overall access to the network.
- Data is transmitted in only one direction

Advantages
- The system is not dependent on a central computer.
- Using fibre optic links, good transmission speeds can be achieved over a wide area.
- This system works effectively when processing is distributed across a number of remote sites.

Disadvantages
- The effective running of the system is dependent on one communication link.
- If this malfunctions, the whole system goes down.
- If one node malfunctions, it can have a negative effect on the whole system.

Mesh Topology
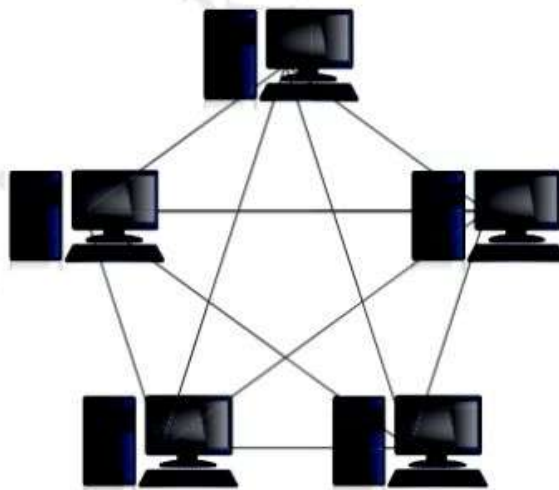
In this type of topology, a host is connected to one or multiple hosts. This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection with few hosts only.

Hosts in Mesh topology also work as relay for other hosts which do not have direct point-to-point links. Mesh technology comes in two types:

Full Mesh: All hosts have a point-to-point connection to every other host in the network. Thus for every new host n(n-1)/2 connections are required. It provides the most reliable network structure among all network topologies.
Partially Mesh: Not all hosts have a point-to-point connection to every other host. Hosts connect to each other in some arbitrary fashion. This topology exists where we need to provide reliability to some hosts out of all.

Tree Topology
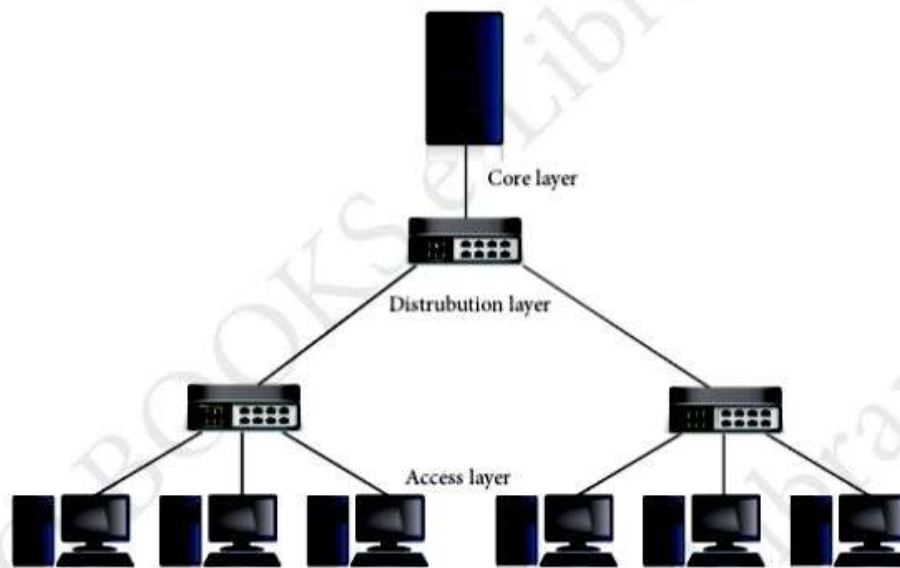
Also known as Hierarchical Topology, this is the most common form of network topology in use presently. This topology imitates as extended Star topology and inherits properties of Bus topology.

This topology divides the network into multiple levels/layers of network. Mainly in LANs, a network is bifurcated into three types of network devices. The lowermost is access-layer where computers are attached. The middle layer is known as distribution layer, which works as mediator between upper layer and lower layer. The highest layer is known as core layer, and is the central point of the network, i.e. root of the tree from which all nodes fork.

Internet Service Providers (ISPs)

When you want to access whatsapp or facebook on your phone you have to buy bundles right? You may wonder how ISPs actually allow you to connect to the internet. They can't possibly just have millions of wires that connects everything... can they? And if you had the money, is it possible for you to connect to the internet just by yourself and not through an isp?

The internet is basically a web of interconnected networks - which are maintained by a huge number of different ISPs. They keep people connected around the world by giving their client access to other ISP networks. This is called peering.

Many ISPs have other services such as e-mail and web hosting service.

ISPs offer different types of connections such as dial-up, through optical fiber wires, cable television connection, or wireless. Communication satelite connections are used mainly in remote areas. Dial-up is the slowest connection, while a direct fiber-optic connection is usually the fastest.

Examples of some ISPs are listed below. They may be wired directly to a home or business or beamed wirelessly via satellite or other technologies.

Operator	Name
ZOL Zimbabwe	ZOL Fibronic Power Pack
Yo! AFRICA	Business Broadband Packages
ZARNet	ZARNet Hotspot
I ♥ LMAX	Monthly MAX
utande	Utande Uncontended Broadband
ECONET	Data Bundle
ECONET	Daily Data Bundles Econet
africom	Late Night Browsing
OneWeb	OneWeb Broadband Satelite
telecel	Telecel Facebook bundles

End of chapter questions

1. Example of a computer full duplex mode is
   A. telephone
   B. internet broadcasting
   C. both A and B
   D. television

2. Computer data transmission mode in which data can flow in both directions but not at same time is called
   A. simplex mode
   B. half duplex mode
   C. full duplex mode
   D. duplex mode

3. Example of a computer simplex mode is
   A. television broadcast
   B. radio
   C. both A and B
   D. internet

4. What is Data Communication?

5. Explain 3 different types of topologies

6. Explain the 3 basic different types of networks

Chapter 5
Security and Ethics (Unhu/ Ubuntu/ Vumunhu)

In this chapter you will learn about
- Computer crime
- Data protection measures
- Computer Ethics

Intoduction

While computers and the internet have made our lives easier in many ways, it is unfortunate that some people also use these technologies to take advantage of others to commit crimes. Such crimes may threaten a nation's security and financial health. Therefore, it is smart to protect yourself from any of these crimes.

Everybody is using computers, from white collar criminals to terrorist organizations and from teenagers to adults.

What is computer crime?

Computer crime is any crime where –
- Computer is a target.
- Computer is a tool of crime
- Computer is incidental to crime. It is not a primary instrument of crime but simply facilitates it.

Computer crime is an act performed by a knowledgeable computer user, sometimes referred to as a hacker that illegally browses or steals a company's or individual's private information. In some cases, this person or group of individuals may be malicious and destroy or otherwise corrupt the computer or data files. Computer crime can also be referred to as cyber crime, e-crime, electronic crime, or hi-tech crime.

Examples of computer crimes
Below is a listing of the different types of computer crimes today.
- **Child pornography** - Making or distributing child pornography.
- **Cracking** - Breaking or deciphering codes that are being used to protect data.
- **Cyber terrorism** - Hacking, threats, and blackmailing towards a business or person.
- **Cyberbullying or Cyberstalking** - Harassing others online.
- **Creating Malware** - Writing, creating, or distributing malware (e.g., viruses and spyware.)

- **Denial of Service** - Overloading a system with so many requests such that it cannot serve normal requests.
- **Espionage** - Spying on a person or business.
- **Fraud** - Manipulating data, e.g., changing banking records to transfer money to an account.
- **Harvesting** - Collect account or other account related information on other people.
- **Identity theft** - Pretending to be someone you are not.
- **Intellectual property theft** - Stealing practical or conceptual information developed by another person or company.
- **Phishing** - Deceiving individuals to gain private or personal information about that person.
- **Salami slicing** - Stealing tiny amounts of money from each transaction.
- **Scam** - Tricking people into believing something that is not true.
- **Spamming** - Distributed unsolicited e-mail to dozens or hundreds of different addresses.
- **Spoofing** - Deceiving a system into thinking you are someone you really are not.
- **Unauthorised access** - Gaining access to systems you have no permission to access.
- **Wiretapping** - Connecting a device to a phone line to listen to conversations.
- **Hacking** - It is an illegal practice by which a hacker breaches the computer's security system of someone for personal interest.
- **Unwarranted mass-surveillance** - Mass surveillance means surveillance of a substantial fraction of a group of people by the authority especially for the security purpose, but if someone does it for personal interest, it is considered as cybercrime.

Possible Criminals for cyber crime
- Disgruntled employees.
- Business Rival.
- Ex-lovers.
- Teenagers.
- Professional Hackers.
- Drug Traffickers

Cyber Crime Victims
- Gullible
- Desperados and greedy people
- Unskilled & Inexperienced
- Careless talk people
- Unlucky people

Some of the cyber crime tools

1. **Wi-Fi Tracking**

   Your own computer could provide a means of tracking you! Most laptops are wireless-fidelity (wi-fi) enabled. Anyone knowing your computer name (eg. Zidan's laptop) can easily listen to your broadcast signal within a few hundred metres to ascertain your whereabouts.

2. **Packet Sniffers**

   Apart from locating you via your computer, someone with a program like a packet sniffer can actually grab the data you type and read it (if it is unencrypted) Remember data is sent in packets. "Sniffing" is similar to a dog lifting its snout to find a scent. Packet sniffers are free on the net. They can listen for keywords such as login and passwords to gain access to information

3. **Bluetooth Locating**

   Bluetooth broadcasts a stronger signal than wi-fi covering greater distances. Whole pages of information can be snapped up (using photographing techniques) and transferred onto a computer by bluetooth.

Cyber Security

Cyber security is a potential activity by which information and other communication systems are protected from and/or defended against unauthorized use or modification or exploitation or even theft.

Likewise, cyber security is a well-designed technique to protect computers, networks, different programs, personal data, etc., from unauthorized access.

Countering Cybercrime

- Don't share access to your computers with strangers
- If you have a Wi-Fi network, protect it with a password
- Avoid illegal downloads
- Use anti-virus software and firewalls - keep them up to date
- Keep your operating system up to date with critical security updates and patches
- Don't open emails or attachments from unknown sources or be careful with attached documents and emails.
- Never keep a default password. Passwords such as "password," "root," "admin," or no password at all allow easy access to your computer or Internet accounts.
- Change passwords often. It is recommended at least once every 2 weeks.

- Use an alphanumeric password. When creating a password, add numbers or other characters to the password to make it more difficult to guess; for example, 1mypassword23!.
- Do not use sticky notes around your computer to write down passwords.
- Use hard-to-guess passwords
- Don't use words like name of your parents, siblings, DOB, number plate of your vehicle e.t.c
- Don't use words found in a dictionary. Remember that password cracking tools exist
- Back-up your computer data on disks or CDs often
- Use a firewall - Firewalls monitor traffic between your computer or network and the Internet and serve as a great first line of defense when it comes to keeping intruders out.

Socia media tips e.g facebook
- Tip 3: Refrain from updating your site too often.
- Tip 4: Don't create or join groups of which you wouldn't be proud to tell your mother you're an "active" member.
- Tip 5: Don't request friendship of people you don't know.
- Tip 6: Don't post messages on the walls of people you don't know
- Tip 7: If you're going to put a picture of yourself on Facebook, make sure it's the best one you can find.
- Tip 8: Don't initiate (or respond to) chain mail.

Characteristics of safe and unsafe sites

Cyber criminals can lure you to malicious websites that can be used to install dangerous software on your computer or to steal your personal information. If you know the signs that websites are trustworthy, you can help protect yourself and your family.

Confirm that the web address begins with HTTPS

If the URL in the address bar starts with HTTPS (instead of HTTP), the page is more secure.
Never type passwords or other personal information unless you see the HTTPS.

Look for a lock in the address bar
A lock icon in the address bar also indicates a more secure connection, which makes it harder for a hacker to view the information that you type.
Check the seal of approval
You can increase your privacy and security by shopping only at sites and using

only services that have been certified by an Internet trust organisation e.g. TRUSTe website, Web Trust website or the BBB Online website.

Note: These seals don't always guarantee that a website is trustworthy. Some unscrupulous websites might display the trust logos fraudulently.

5 signs that a website might not be trustworthy

Here are five reasons NOT to go to a website:
1. You learn about the site or receive a link to it in an email message that was sent by someone you don't know (or by someone in your contact list, but with no explanation).
2. The site offers objectionable content, such as pornography or illegal materials.
3. The site makes offers that seem too good to be true. This can indicate a possible scam or the sale of illegal or pirated products.
4. You are asked for a credit card number as a verification of identity or for personal information that does not seem necessary.
5. You are asked to provide a credit card number on a page that does not start with HTTPS or does not include the lock icon.

1. **Establish strong passwords**
   - Implementing strong passwords is the easiest thing you can do to strengthen your security.
   - You should definitely avoid using: any personal data (such as your birthdate), common words spelled backwards and sequences of characters or numbers, or those that are close together on the keyboard.
   - Use their convenient password checker to see how strong yours is.
   - Change your password every 90 days or earlier.
   - Never write down your password!

2. **Put up a strong firewall**
   - In order to have a properly protected network.
   - A firewall protects your network by controlling internet traffic coming into and flowing out of your business.

3. **Install antivirus protection**
   - Antivirus and anti-malware software are essentials in your online security weapons, as well.

4. **Update your programs regularly**
   Your security applications are only as good as their most recent update. While applications are not 100 percent fool-proof, it is important to regularly update these tools to help keep your users safe. Frequently updating your programs

keeps you up-to-date on any recent issues or holes that programmers have fixed.

5. **Secure your laptops**
    - Because of their portable nature, laptops are at a higher risk of being lost or stolen than average company desktops. It's important to take some extra steps to be certain your sensitive data is protected.
    - Encrypting your laptop. It's the easiest thing to do.
    - Encryption software changes the way information looks on the hard drive so that, without the correct password, it can't be read.
    - Secure your mobile phones

6. **The must-haves for mobile phones:**
    - Encryption software
    - Password-protection
    - Remote wiping enabled

7. **Backup regularly**
    Scheduling regular backups to an external hard drive, or in the cloud, is a painless way to ensure that all your data is stored safely.

8. **Monitor diligently**
    One good monitoring tool is data-leakage prevention software, which is set up at key network touchpoints to look for specific information coming out of your internal network. It can be configured to look for credit card numbers, pieces of code, or any bits of information relevant to your business that would indicate a breach.
    If you don't monitor things, it's a waste of time and a waste of resources. And you won't know that you've been compromised until it's far too late.

9. **Be careful with e-mail and surfing the Web**
    It's common for an unsuspecting employee to click on a link or download an attachment that they believe is harmless -- only to discover they've been infected with a nasty virus, or worse. Links are the number one way that malware ends up on computers. Links are bad!
    You should take every "warning box" that appears on your screen seriously and understand that every new piece of software comes with its own set of security vulnerabilities."

10. **Educate your employees**
    Teaching your employees about safe online habits and proactive defense is crucial.
    "Educating them about what they are doing and why it is dangerous is a more effective strategy than expecting your IT security staff to constantly react to end users' bad decisions. Make sure your employees understand how important your company's data is, and all the measures they can take to protect it.

Computer ethics

What are ethics?

Ethics are a set of moral principles that governs an individual or a group on what is acceptable behaviour.

Examples of unethical behavior among individuals

- Lying to your spouse about how much money you spent.
- Lying to your parents about where you were for the evening.
- Stealing money from the petty cash drawer at work.
- Lying on your resume in order to get a job.
- Talking about a friend behind his back.
- Taking credit for work you did not do.
- Cheating on a school paper by copying it off the Internet.
- Taking $20.00 out of your friend's wallet when he is sleeping.
- Using your position of power at work to sexually harass someone.
- Selling a house and not disclosing known defects to the buyers.
- Selling a car and lying about the vehicle's accident history

Computer ethics are a set of moral principles that govern the usage of computers. One of the common ethics missed by many among computer ethics is violation of copyright issues. For example, while it is easy to duplicate copyrighted electronic or digital content, computer ethics would suggest that it is wrong to do so without the author's approval. And while it may be possible to access someone's personal information on a computer system, computer ethics would advise that such an action is unethical.

Stories that can cause any educator nightmares:

- A student is caught downloading pornographic materials on school computers
- A student is abducted by a stranger she has met in an Internet chat room
- A group of students hack into a school server and cause damage
- A student uses the printer in the computer lab to print reams of encyclopedia pages
- A student sets up a satirical "school" website that appears critical for individual teachers
- Parents complain to the school board when their children are suspected of plagiarizing materials from the Internet
- A student cut and paste a whole assignment from the internet straight to his or her book.
- Students use the Internet to locate information from hate groups etc.
- Some examples of unethical behaviour of students/teachers?

1. **Digital plagiarism:**

Plagiarism is one of the major forms of academic dishonesty which has always existed in education, including higher education. For example, assignments submitted by students may turn out to be copied from fellow students or could be taken over, in part or in whole, from existing published works. The use of computers and the Internet added to the means that students have at their disposal to commit plagiarism. However, they make it much easier to do and much harder to detect.

When we forget to submit our homeworks, at times the evil idea hits our minds.....

Consequences of plagiarism include:
- Destroyed Student Reputation
- Destroyed Professional Reputation
- Destroyed Academic Reputation
- Legal Repercussions
- Monetary Repercussions

2. Pirating

Pirating is one of the most common ways to use a computer unethically. Pirating includes downloading software or files, including games, movies and photo-editing programs. Pirating in cyberspace is equivalent to stealing. Likewise, using an image on a website without giving credit to the original creator is also considered as stealing.

3. Hacking

This is another way to use computers unethically. Hacking is the act of invading another person's files or computer to take valuable assets or information. Hacking can also quickly turn into identity theft and exploitation.

4. Bullying

This is a rising trend in cyberspace, especially with the popularity of social networks, such as Twitter and Face book. Bullying is the act of intimidating someone through violent or threatening means. Calling someone names or harassing someone in cyberspace can lead to very serious consequences and can even contribute or even result in a victim's suicide.

5. Inappropriate Computer Use

Employees may use company computers to engage in unethical behaviour. For example, an employee who is not permitted to use the Internet for personal reasons commits an unethical act by shopping online while at work. Random Internet surfing wastes time supposed to be spent on work-related activities. Employees sometimes use company email to spread inappropriate websites or videos to co-workers, some of which could be deemed offensive by the recipients.

5. **Time Misuse**

   Unethical behaviour can include "stealing" time from the company, as the company is compensating employees and receiving no productivity in return. In addition to time spent on aimless Internet surfing, time misuse can consist of extending breaks beyond the allotted time, congregating around the water cooler or engaging in lengthy gossip sessions during working time, falsifying time sheets, coming to work late or leaving early and running personal errands while travelling on company business.

6. **Illegal Acts**

   Some unethical acts can also be illegal. For example, an employee who has access to a company's financial records, such as a bookkeeper or accountant, could use her access and expertise to embezzle company funds. An employee having access to personnel files, such as a human resources representative, could commit identity theft and use employees' Social Security numbers to raid bank accounts or fraudulently obtain credit cards. In cases such as the 2001 Enron scandal, top company executives used questionable accounting practices to manipulate the company's stock price for their own financial gain.

The Ten Commandments of computer ethics have been defined by the Computer Ethics Institute. Here is our interpretation of them:

1. Thou shalt not use a computer to harm other people: If it is unethical to harm people by making a bomb, for example, it is equally bad to write a program that handles the timing of the bomb. Or, to put it more simply, if it is bad to steal and destroy other people's books and notebooks, it is equally bad to access and destroy their files.

2. Thou shalt not interfere with other people's computer work: Computer viruses are small programs that disrupt other people's computer work by destroying their files, taking huge amounts of computer time or memory, or by simply displaying annoying messages. Generating and consciously spreading computer viruses are unethical.

3. Thou shalt not snoop around in other people's files: Reading other people's e-mail messages is as bad as opening and reading their letters: This is invading their privacy. Obtaining other people's non-public files should be judged the same way as breaking into their rooms and stealing their documents. Text documents on the Internet may be protected by encryption.

4. Thou shalt not use a computer to steal: Using a computer to break into the accounts of a company or a bank and transferring money should be judged the same way as robbery. It is illegal and there are strict laws against it.

5. Thou shalt not use a computer to bear false witness: The Internet can spread false news as fast as it can spread true issues. Putting out false "information" to the world is bad. For instance, spreading false rumors about a person or false propaganda about historical events is wrong.

6. Thou shalt not use or copy software for which you have not paid: Software is

an intellectual product. In that way, it is like a book: Obtaining illegal copies of copyrighted software is as bad as photocopying a copyrighted book. There are laws against both. Information about the copyright owner can be embedded by a process called watermarking into pictures in the digital format.

7. Thou shalt not use other people's computer resources without authorization: Multiuser systems use user id's and passwords to enforce their memory and time allocations, and to safeguard information. You should not try to bypass this authorization system. Hacking a system to break and bypass the authorization is unethical.

8. Thou shalt not appropriate other people's intellectual output: For example, the programs you write for the projects assigned in this course are your own intellectual output. Copying somebody else's program without proper authorization is software piracy and is unethical. Intellectual property is a form of ownership, and may be protected by copyright laws.

9. Thou shalt think about the social consequences of the program you write: You have to think about computer issues in a more general social framework: Can the program you write be used in a way that is harmful to society? For example, if you are working for an animation house, and are producing animated films for children, you are responsible for their contents. Do the animations include scenes that can be harmful to children? In the United States, the Communications Decency Act was an attempt by lawmakers to ban certain types of content from Internet websites to protect young children from harmful material. That law was struck down because it violated the free speech principles in that country's constitution. The discussion, of course, is going on.

10. Thou shalt use a computer in ways that show consideration and respect: Just like public buses or banks, people using computer communications systems may find themselves in situations where there is some form of queuing and you have to wait for your turn and generally be nice to other people in the environment. The fact that you cannot see the people you are interacting with does not mean that you can be rude to them.

End of chapter questions

1. Firewalls are used to protect against (1)
    A. Data driven attacks
    B. Fire attacks
    C. Virus attacks
    D. Unauthorised access

2. Ethics are: (1)
    A. Official rules
    B. Personal beliefs
    C. Moral principles
    D. Community guidelines

3. Which of the following is NOT a rule listed in Computer Discovery's Ten Commandments of Computer Ethics?
    A. Thou Shalt NOT use a computer to lie
    B. Thou shalt NOT copy copyrighted software and materials
    C. Thou shalt NOT use a computer to plagiarise
    D. Thou shalt NOT respect other at all times when using the computer.
    E. Bullying someone in the hallway

4. What is computer crime? (2)

5. What is cyber crime? (2)

End of term test

1. What is the equivalent denary number of the binary number 01001011?
   A. 74
   B. 43
   C. 75
   D. 85

2. How many bytes are there in one kilobyte (kB)?
   A. 1024
   B. 1048576
   C. 8
   D. 11

3. Programs that run on a computer are referred to as
   A. hardware
   B. software
   C. file ware
   D. soft firm

4. Computers process data under the control of sets of instructions termed as
   A. computer programs
   B. computer data
   C. computer buses
   D. computer instructions

5. To join the internet, the computer has to be connected to an
   A. internet architecture board
   B. internet society
   C. internet service provider
   D. none of the mentioned

6. Diagnosis Software is used to:
   A. Monitor activity and health of software
   B. Heal the sick
   C. Stop Viruses
   D. Format a disk

7. Which of the following transmission modes send data on both directions but not simultaneously?
   A. Half duplex
   B. Full duplex
   C. Simplex
   D. Quarter duplex

8. Which of the following is not a computer crime
   A. Hacking
   B. Phishing
   C. Advertising
   D. Spoofing

9. Software that protects your computer from malware is called
   A. MS Word
   B. Anti- Virus
   C. Ad-ware
   D. Virus

10. Technology used to determine one's geographical location is called
    A. GPS
    B. Trojan
    C. Dial-up
    D. RAM

11. Which of the following is NOT an example of cyber bullying?
    A. Creating an embarrassing picture of your classmate and forwarding it to your friend's email addresses
    B. Sending someone a mean text
    C. Bullying someone in the hallway
    D. Threatening someone in an instant message

12. Types of software programs are
    A. Application programs
    B. Replicate programs
    C. Logical programs
    D. both A and B

13. Specialized program that allows user to utilize a specific application is classified as
    A. relative programs
    B. application programs
    C. relative programs
    D. replicate programs

14. Which of the following is NOT a type of application software?
    A. Word processor
    B. Database
    C. Device driver
    D. Browser

15. Ethical issues are important (1)
    A. Because we should be nice to everyone
    B. Whenever our behaviour affects other people
    C. Only when we are being observed
    D. To academics

Structured Questions

1. Give TWO reasons why you would want or need to upgrade the hardware of your computer, other than hardware failure. (2)

2. State TWO ways in which a user could install software on a computer that does not have an optical drive. (2)

3. Give TWO potential disadvantages of upgrading to a newer version of an office suite, other than any costs involved. (2)

4. Explain what phishing is AND why updating your antivirus program will not prevent you from becoming a victim of phishing. (2)

5. To which type or category of application software do Microsoft Edge and Mozilla Firefox belong? (1)

6. State TWO ethical considerations to keep in mind when connecting to someone else's Internet connection. (2)

7. Computers use _____ language (1)

8. Give any 4 types of unguided transmission media (4)

9. Convert denary 84 to binary (4)

10. Add 1001 and 1101 (2)

11. State any two activities that would be included in the feasibility study. (2)

12. VIRUS stands for.........(2)

(40 marks)

Chapter 6
System Analysis and Design

In this chapter you will learn about:
- Feasibility study
- Carrying out a feasibility study

Feasibility Study

A feasibility study is performed by an organization in order to evaluate whether a specific action makes sense from an economic or operational point. The objective of the study is to test the feasibility of a specific action and to determine and define any issues that would argue against this action.

The question a feasibility study essentially tries to answer is: "Should we proceed with the specific action plan?" On top of determining whether the plan is viable, organizations can use a feasibility study for understanding the risks better and preparing for them.

The Feasibility Study is a critical document which defines the initial system concepts, objectives, requirements, and alternatives. The study also forms the framework for the system development project and establishes a baseline for further studies.

If the system proposal is approved, the next phase is to test whether the proposed system meets the user's requirements; uses resources effectively and; is cost effective. These are known as technical, operational, economic and Legal feasibility studies.

Types of feasibility

Economic Feasibility

Also known as cost benefit analysis to determine the benefits and savings that are expected from a candidate system and compare them with costs. If Benefits outweigh Costs, then the decision is made to Design and Implement the system. It involves the cost incurred on the software development team, estimated cost of hardware and software, cost of performing feasibility study, and so on. For this, it is essential to consider expenses made on purchases (such as hardware purchase) and activities required to carry out software development. In addition, it is necessary to consider the benefits that can be achieved by developing the software. Software is said to be economically feasible if it focuses on the issues listed below.

- Cost incurred on software development to produce long-term gains for an organization
- Cost required to conduct full software investigation (such as requirements elicitation and requirements analysis)
- Cost of hardware, software, development team, and training.

Technical Feasibility

Technical feasibility assesses the current resources (such as hardware and software) and technology, which are required to accomplish user requirements in the software within the allocated time and budget. For this, the software development team ascertains whether the current resources and technology can be upgraded or added in the software to accomplish specified user requirements. Technical feasibility also performs the following tasks: -

- It checks whether the existing computer system supports the candidate system or not or up to what extent it supports.
- Analyses the technical skills and capabilities of the software development team members
- Ascertains that the technology chosen for software development has a large number of users so that they can be consulted when problems arise or improvements are required.

Operation Feasibility

Operational feasibility assesses the extent to which the required software performs a series of steps to solve business problems and user requirements. This feasibility is dependent on human resources (software development team) and involves visualizing whether the software will operate after it is developed and be operative once it is installed. Operational feasibility also performs the following tasks.

- Determines whether the problems anticipated in user requirements are of high priority
- Determines whether the solution suggested by the software development team is acceptable
- Analyses whether users will adapt to a new software

Legal Feasibility

Determines whether the proposed system conflicts with legal requirements, e.g., a data processing system must comply with the local data protection regulations and if the proposed venture is acceptable in accordance with the laws of the land.

Social Feasibility

- It looks to the social effects of introducing the new system.
- For example, if a proposed system will lead to a large number of people to be put out of work due to computerisation, employee organisations and government may object.
- It also considers how well the proposed system will be received by the end users and the possibilities of resistance to change.

Conducting a feasibility study

Now that we've examined the different core elements of a feasibility study, we can look at the steps you need to take in order to conduct a feasibility study.

1. Conduct preliminary analysis

A feasibility study can be a time-consuming process and it doesn't come without its costs. Therefore, it is very important to start a preliminary analysis. This is essentially a pre-screening of the proposed action and it examines whether a proper feasibility assessment is worth the time and money.

For example, before you conduct a feasibility study on the viability of acquiring a business, you want to check quickly the overall attainability of the action. If the acquisition is so risky that it could bankrupt your business, there's no reason for conducting a proper feasibility study.

Preliminary assessment should consist of the following steps:

- First, you want to outline the planned idea or action. This means looking at what you want to achieve and why.
- Second, you should examine the market space and the commercial viability of the action. You want to get an over view of what type of customers are you potentially attracting.
- Third, you should examine the unique characteristics of the idea and whether they are a strength or a weakness. The idea or action might have certain unique characteristics (i.e. location, price, usability) and these might help your organization.
- Fourth, you need to determine if there are greater risks to the action which are difficult to overcome. It's essential to outline any risks that could possibly reduce the viability of the action or idea close to zero.

Keep in mind that the above is just to get an overall feel of the idea. You don't need to conduct full market research at this point, but simply understand whether there's any kind of space for the action within the market.

If your preliminary analysis doesn't find any difficult obstacles and the commercial viability is possibly there, you can continue with the proper feasibility study.

2. Outlining the project scope and conducting current analysis

Next, you should move on to outlining the project scope by defining the area of study for the feasibility study. Do you need to look at all five elements of the study, for example?

The scope must be detailed and outline the objectives of the feasibility study clearly. It's a good idea to examine the above five elements in terms of your action or idea and create an action plan for each section that applies to the project.

It's essential to study the different parts of your business that might be influenced by the proposed action or idea, even when you aren't proposing something that impacts the whole business directly (i.e. launching a new product, acquiring a business or starting a business). Actions, such as hiring new personnel to a single department, can sometimes have an impact on sectors that might not immediately seem obvious.

The key to outlining the scope is about understanding the different participants and end-users of the proposed idea or action. For instance, if you are moving the business to new premises, you have to understand the impact it'll have on the workforce (change in commute can have an impact on employee morale,

etc.) and the customer (will all customers follow your business to a new location, etc.).

Finally, you also need to analyse the current situation prior to the implementation of the idea or action. You can do so by describing the weaknesses and strengths of the business. Once you've done this, you can study the savings and the operational benefits you are hoping to achieve with the new proposal.

3. **Comparing your products with existing products /services**

You will need to research the current competitive landscape in order to understand whether the proposed ideal or action is viable. Whether you are implementing a new software or equipment or launching your own new product, you need to compare the proposed product or service with other similar items on the market.

This might mean you need to compare the feasibility of your chosen software (for example, accounting platform) with other products on the market. What are the benefits of your proposed choice and what are the weaknesses? Are the risks associated with your chosen software smaller or bigger than those of competitive products?

The same analysis applies when launching a new product. Part of your feasibility study must then focus on understanding what the customers are looking for and whether your proposed ideal answers needed. You should also compare the proposed product with the existing products or services and focus on the advantages, as well as disadvantages, you might have.

4. **Examining the market conditions**

You also need to examine the market conditions. There are four specific points when it comes to the analysing market in terms of feasibility.
   - Defining the target market.
   - Studying the buying habits of the target market.
   - Understanding the sale and market share outlook of the proposal.
   - Outlining the product awareness required for the use of your product or service.

The main goal of this part of the feasibility study is to understand the revenue projection for implementing the proposed idea or action. You want to have a realistic understanding of the kind of sale numbers you can expect and the scope of the promotional activities you are required to undertake.

For example, in terms of product or service awareness, you must be able to determine the type of marketing required for potential customers to understand and be able to use the item.

5. **Understanding the financial costs**

One of the most important steps for concluding a feasibility study involves calculating the financial costs related to the proposal. No matter what type of idea or action your organization is considering, the financial cost of it can be the

major point in determining its viability.

The first rule of any successful business is the need to have income or it goes bust. Therefore, any action your organization takes has to examine the impact it'll have on the income and profit of the business.

The financial costs associated with your proposed idea or action will naturally depend on the proposal. But you have to consider the following points in all instances:

- The resources required to implement the idea or action.
- The source for these resources: internal or external financing.
- The realistic benefits of the idea or action, whether it's sales figures, boost in productivity, or a cut in operational costs.
- The break-even schedule for the proposal. This refers to the time it takes to a point when the profits from the idea or action equal the costs associated with it.
- The financial risks associated with the idea or action. This can refer to risky market conditions, the probability of requiring more resources and so on.
- The financial cost of failure. You also need to calculate the financial cost of the worst-case scenario. This can determine whether your business has the means of embarking on this new venture or not.

The likelihood of having to use estimates in the above calculations is relatively high. It's important to conduct proper research and to be as realistic with your figures as possible. After all, positive surprises (for example, exceeding sales figures) are not difficult to manage, unlike overly positive calculations that turn out wrong.

6. Reviewing and analysing data

Finally, you need to review your feasibility study carefully and examine the findings with time. A good rule of thumb is to simply take a step back and reflect on the research before jumping into conclusions.

After your study, look around and consider the following questions:

- Are there any risks you weren't aware of previously?
- Have the market conditions changed?
- Has the competition changed?
- Is your business situation still the same, in terms of operations and economic situation?

If the conditions have changed, you can review these parts of the feasibility study. Once you've reviewed your results, you can go ahead with the final decision. The feasibility study should provide you the answer of either moving ahead with the proposed idea or action, or scrapping the idea and looking for something different.

Example of a feasibility study

How to Conduct a Feasibility Study for a New Restaurant
by Brian Hill

Entrepreneurs who start new restaurants may overestimate the size of the market in their area and not take into account the tough competition they will face from established restaurants with loyal clientele. Doing a feasibility study prior to investing the time and money to open a restaurant can help an entrepreneur make a more informed decision about the venture's chances of success.

Obtain Market Statistics

Studying demographic characteristics such as age and income will help you estimate the size of your potential market. If you are planning a mid-price, family-style restaurant for example, you need to know how many families reside in your area. A heavy population of singles or college students will probably not support your restaurant. The U.S. Department of Commerce Census Bureau website is a good place to begin your research.

Evaluate Potential Locations

A high-traffic location is preferable, one close to major streets with lots of visibility to vehicle or pedestrian traffic. Make sure parking is ample and easy for customers to access. Look for businesses in the area that could create demand for your restaurant -- large office complexes, hotels or retail centres for example. Be sure to consider the trade-off between a location's suitability and the lease cost. Saddling a new restaurant with a lease payment that is too high can make it extremely difficult for the venture to reach positive cash flow.

Review the Competition

Look not only at the total number of restaurants in your immediate area but also at the styles of restaurants that are prevalent. Consider whether your area is already saturated with restaurants similar to the concept you will be offering -- similar cuisine, price point and target markets. Analyse the strengths and weaknesses of each major competitor and determine whether your proposed restaurant will stand apart from competitors and be memorable to customers.

Study the Industry

Join your state or local restaurant and hospitality organizations. Attend their meetings, talk with other restaurant owners and review any statistical information they publish about the growth and health of the industry. The National Restaurant Association also publishes studies and statistics about industry trends and growth. Decide whether given the current economic environment it is advisable to launch a new restaurant. Find out if any restaurants in the area have closed in the last two years and why.

Look at Your Cost Structure

Once you have a good idea what type of food you want to offer, break down the cost of each menu item. Determine who your major suppliers will be and ask them

for pricing. Software programs are available to help you accurately calculate the projected food costs. You may consider reducing the number of items on your menu to keep food cost down. You may also find that given the food cost projections, the prices you will have to charge are higher than your local market will support.

Evaluate Management Capability

An entrepreneur contemplating opening a restaurant should take a hard look at whether he has the skill set and experience to make the venture a success. He should ask himself whether he has the eye for detail to maintain high customer satisfaction. He needs to be able to train and motivate staff members who may have limited experience or education. He needs to understand how to make the kitchen operation run smoothly. He may determine that it is not feasible for him to be the general manager of the restaurant's operations and elect to hire a manager who already has a track record of success in the industry

Activity/Research
Carry out a feasibility study of a topic of your choice and write a feasibility report.

End of chapter questions

1. Which of the following is a type of feasibility study?
   a. Operational feasibility
   b. Legal feasibility
   c. Technical feasibility
   d. Social feasibility
   e. All of the above

2. Operational feasibility is a measure of how well a proposed system solves the problems and takes advantage of the opportunities for the system
   a. True
   b. False

3. One of the major issues addressed in technical feasibility study is whether the proposed technology or solution is practical.
   a. True
   b. False

4. Which type of feasibility focuses on total cost of ownership?

5. Which type is influenced primarily by users?

Chapter 7
Algorithms Design and Problem-solving

In this chapter you will learn about:
- Selection and repetition constructs
- Applying selection and repetition algorithm structures in problem solving

What is an Algorithm?

An algorithm is merely the sequence of steps taken to solve a problem. The word sequence means there is an order to the instruction.

Pseudo code

pseudo-, means 'false' and code, means 'programming instructions'.
- It describes the detailed steps your program must perform without having to worry about the specific vocabulary or syntax of a specific programming language.
- You use your knowledge, common sense and logic to write plain-English statements to explain in detail how you will accomplish each main step

Algorithm constructs

Constructs are steps to write an algorithm and these are normally "sequence", "selection", "iteration/repetition" and case type statements.

Section

- The selection control structure is the presentation of a condition and the choice between two (or sometimes more) actions.
- The choice made depends on whether the condition is true or false.
- Thus the condition must be a Boolean expression which yields only true possible values that is true or false.
- Selection can also be called decision making or branching.
- It has two distinct constructs that can differ on syntax depending on the programming language though on pseudo code they will be the same.
- The two constructs are If… Then… Else… End If and Case statement.

IF...THEN ...ELSE statement: A programming structure that allows the user to choose one from at least two routes of solving a problem. The syntax of the If… Then… Else will be as follows

IF <CONDITION> THEN
    Statement 1
    Statement 2

ELSE
Statement 3
Statement 4
END IF

- The condition will be a Boolean expression which will yield to either TRUE or FALSE.
- If the condition is true, statement 1 and 2 will be executed and statements 3 and 4 will be skipped.
- When the condition is false then the statements 1 and 2 will be skipped and the statements 3 and 4 will be executed.

If statement can have some variations which include
If… End If
This flair is normally used when there is one option needed. For example, the program is expected to check the presence of data in a field and do nothing if it is present or display an error message for missing fields

If Field = Empty Then
        Display Error Message
End If

If…ElseIf…Else… End If
This type is used when there are more than two possible options to be decided or chosen. For example, a program might want to decide whether a learner is in form 1 or form 2, or form 3 or form 4.

If form = 1 Then
    Display learner is in Form 1
ElseIf form = 2 Then
    Display learner is in Form 2
ElseIf form = 3 Then
    Display learner is in Form 3
Else
    Display learner is in Form 4
End If

If…If…End If…End If (This one is called nested Ifs)
This option is used when there is more than one condition to be tested and become true for an action to be considered. For example, for a learner to go for a trip, the learner must be a male, the learner must be in form 2, the learner must have a Building Technology as a practical subject

```
If gender = Male Then
    If form = 2 Then
            If PracticalSubject = "Building Technology" Then
                    Display learner must go for trip
            End If
    End If
End If
```

CASE STATEMENT:
- This is an alternative to the IF...THEN...ELSE statement and is shorter when there are more than two possible options.
- Using the If Statement, will imply nesting them (putting a construct inside another construct) which might become very clumsy.
- With the IF... THEN ...ELSE statement, the program is coded in conditional execution of two groups of instructions.
- The Select Case allows the program to take any number of branches.

General Syntax
SELECT CASE <expression>
CASE<expression> to <expression>
Statements
Or
CASE IS <relational operator>
Statements
END SELECT CASE
The expression (in the Select Case) is evaluated, and instructions are provided for each Case (Value Range).

Example of a case statement
```
START
    Enter Mark
    Select Case Mark
            Case 80 to 100
                    grade = "Distinction"
            Case60 to 79
```

```
                grade = "Credit"
        Case50 to 59
                grade = "Pass"
        Case0 to 49
                grade = "Fail"
        End Select Case
    STOP
```

Iteration/Repetition

- Sometimes you want the computer to execute the same lines of code several times. This is done using a loop.
- A loop is an occurrence of a repetition.
- There are three types of loops: For loops, while loops and repeat until loops.
- The iteration has statements such as "for...to...next, while...endwhile and repeat...until"
- An essential feature of repetition is that each loop has a termination condition to stop the repetition, or the obvious outcome is that the loop never completes execution.
- This is known as an infinite loop and is obviously undesirable. A number of instructions are repeated

For...Next Loop:

- A looping structure that repeatedly executes the loop body for a specified number of times.
- It is used when you know in advance the number of times which you want to repeat the operations.
- The syntax of the For...Next loop is as follows:

FOR {variable} = {starting value} to {ending value} DO

```
        Statement 1   ⎫
        Statement 2   ⎬ loop body
        ....................
        NEXT{variable} ⎭
```

```
Start
Sum, Average = 0

FOR i = 1 to 5 DO
    Enter Number
    Sum = Sum + number
NEXT i
Average = Sum/5
Display Sum, Average
End
```

ACTIVITY:
Write a pseudo code that will allow the user to enter Marks for Computer Studies test results of ten learners. The program should also calculate the average mark for the test. Finally, the program should display the total marks entered and average. **[15 marks]**

Repeat...Until Structure:

It is a looping structure that repeatedly executes the loop body for a specified number of times. The syntax of the Repeat...Until loop is as follows:

Repeat
```
        Statement 1 ⎫
        Statement 2 ⎬ loop body
        ................ ⎭
```

Until{Condition}

```
START
Sum, count=0
REPEAT
Enter number
Sum += number
Count+=1
Until count > 10
average = Sum/10
```

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Display Sum, average
STOP

While ... Do Statement:
- A looping structure in which the loop body is repeatedly executed when the condition set is TRUE until it becomes FALSE.
- It is used when the number of repetitions is not known in advance.
- The condition set is tested first before execution of the loop body.
- Therefore, the loop body may not be executed at all if the condition set is FALSE from start.
- The syntax of the WHILE…END WHILE structure is as follows:

WHILE{Condition}

> Statement 1 ⎫
> Statement 2 ⎬ loop body
> .... ⎭

ENDWHILE

An example of the while...loop is as follows:
START
Sum, count=0
WHILE count< 10
       Enter number
       Sum += number
       Count+=1
END WHILE

STOP

Nested Constructs
- When a construct appears in another construct it will be called nested constructs. We can have the same type of a construct appearing in another construct of the same such as IF statement within another IF, in this case it will be called nested ifs.
- However, the If statements can be infused within the repetition constructs that become nested constructs.
- Of course the construct have been described in isolation but in real life they appear nested in most of the times. For example:

START
Sum, count = 0
       Repeat
       Enter number
              If number >0 Then

```
                    Sum += number
                    End if
            count += 1
            Until count >=10
STOP
```

End of chapter questions

1. List the three control structures which are used in algorithm design. [3 Marks]

2. Write a pseudo code that will determine whether an entered number is a prime number or not. [10 Marks]

3. Define the following: (i) pseudocode, (ii) algorithm construct. (2)

4. The three basic logic structures are repetition, selection and .... (2)

5. Which basic structure is also known as a loop structure (2)
   a. Alignment
   b. Sequential
   c. Repetition
   d. selection

6. IF (score > 90) AND (score <= 100):
       PRINT "Your grade is A*"
   This code uses
   a. iteration/repetition
   b. selection
   c. sequence   (2)

7. myAge = 12
   PRINT "Next year I will be: "
   PRINT myAge + 1
   PRINT "In two years I will be: "
   PRINT myAge + 2
   PRINT "In three years I will be: "
   PRINT myAge + 3
   This code uses
       a   iteration/repetition
       b   selection
       c.   sequence   (2)

8. The If...Then statement is called a _____ statement because it selects or ignores one action (or group of actions).
   a. single-selection
   b. multiple-selection
   c. double-selection
   d. repetition

9. The If...Then...Else selection statement ends with the keywords _____. (2)

a. End If Then Else
b. End If Else
c. End Else
d. End If

10. The _____ statement executes until its loop-termination condition becomes True. (2)
   a. Do While...Loop
   b. Do Until...Loop
   c. Do
   d. Loop

11. The _____ statement executes until its loop-continuation condition becomes False. (2)
   a. Do While...Loop
   b Do Until...Loop
   c. Do
   d Do While

12. A(n) _____ loop occurs when a condition in a Do While...Loop never becomes False. (2)
   a infinite
   b undefined
   c. nested
   d indefinite

Chapter 8
Programming

In this chapter you will learn about
- Developing programs that use pseudo code structures
- Developing a program using functions
- Implementation of arrays
- Testing and debugging programs

Programming

Programming means creating a set of instructions for completing some specific task. In this sense, many of our daily activities can be described as programmatic— they involve specific steps that often follow a set order. For instance, if you get home from school and want to make yourself a mayonnaise chicken sandwich, you know that you will have to get two slices of bread, spread mayonnaise on both slices, put chicken steak on one slice and finally put the two together. If you leave out a step you might end up with something other than a chicken mayonnaise andwich. If you do things out of order—say, you put the slices of bread together before you spread the mayonise—you'll end up with a mess.

In the context of computing, programming means creating a set of instructions not for a person but for a computer, in order to achieve a specific task. To do so we use a set of directives (a programming language)—known to both the programmer and the computer operating system.

Control Structures in programming

In a program, a control structure determines the order in which statements are executed. The following flow charts depict the basic control structures in the programming languages:
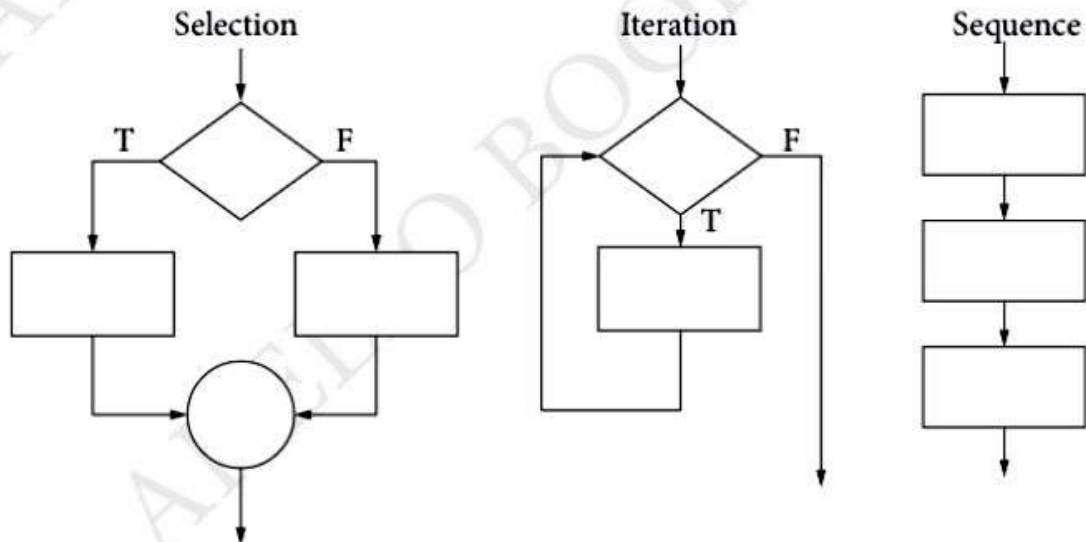
Selection

The selection control structures differ from programming language to programming language. This book will be much inclined to Visual Basic .Net

Selection is used for decision making. If there is decision to be made that is ,when we use selection. Selection in Vb.Net programming takes the form of two constructs, that is, if then else and the select case statement.

If Statement.
It takes the following form

```
If num >= 50 Then
            MsgBox("Its a pass mark")
Else
          MsgBox("Its a fail mark")
EndIf
```

The message it's a pass mark will only be displayed only when the condition is true. When the condition is false the pass mark message will be jumped and the fail mark will be displayed.

Select Case Statement.
This construct is used for decision making especially if there are many options. The construct will be like the following:

```
Select Case num
CaseIs >= 50
            MsgBox("Its a pass mark")
CaseIs < 50
            MsgBox("Its a fail mark")
End Select
```

Repetition / Iteration / Looping

There are three constructs which exist under this control which include: For…Loop, Do… Loop and While… Loop.

For… Loop

This loop is used when the number of repetitions are known in advance. It takes the following format:

```
For i As Integer = 1 To 10
            num = InputBox("Enter Number")
            sum += num
Next i
```

The For…Loop increments itself. By default, it will increment by 1. However, if you want to change the number to increment will you do so by adding another statement in front of ending variable. The statement is Step number, where number is the designated number to increment with. For example:

```
For i As Integer = 5 To 30 Step 5
MessageBox.Show(i)
Next i
```

This means the loop body will be incrementing by 5 between the iterations.

Activity
Write a program that will print the first ten Numbers of the Fibonacci series.

For...Loop can be nested to produce various repetitions. A good example of displaying a pattern of characters on the console screen or in a textbox.

```
#       #       #       #       #       #

#       #       #       #       #       #

#       #       #       #       #       #

#       #       #       #       #       #

#       #       #       #       #       #

#       #       #       #       #       #
```

```
Imports System.Console
0 references
Module ForLoop
    0 references
    Sub Main()


        For i As Integer = 1 To 6
            For j As Integer = 1 To 6
                Write(" # ")
            Next j
            WriteLine()
            WriteLine()
        Next i
        ReadKey()
    End Sub

End Module
```

Do...Loop

This loop is useful when the number of repetitions is not known in advance. It continues executing the loop body until the condition becomes false. The condition is tested after the loop body. It takes the following form:

```
sum = 0
count = 0
Do
        num = InputBox("Please Enter any whole number", "Do Loop")
        sum += num
        count += 1
Loop Until count > 5
```

The instructions between DO and LOOP UNTIL (the loop body) will be repeated upto the time when count will be greater than 5.

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While…End While

This loop is similar to the Do…Loop. It only differs in the sense that this loop tests the condition before the loop body. As such it might not even run if the condition starts with a false value. This also means that it only repeats the loop body only if the condition is true and exit when the condition becomes false, a direct opposite of the Do… Loop. It takes the following form:

```
Dim num, sum, count As Integer
        sum = 0
        count = 0
While count < 5
        num = InputBox("Please Enter any whole number", "While Loop")
        sum += num
        count += 1
End While
```

> **Activity**
> Write a program that will accept a whole number with more than two figures. The program must add the figures and return the total. For example, if the user enters 231 the program must add 2+3+1 and display 6.

The code above implies that the instructions between while and end while will be executed as long the condition count is less than 5 and remains true.

VB.Net - Functions

A procedure is a group of statements that together perform a task when called. After the procedure is executed, the control returns to the statement calling the procedure. VB.Net has two types of procedures:

- Functions
- Sub procedures or Subs

Functions return a value, whereas Subs do not return a value.

Defining a Function

The Function statement is used to declare the name, parameter and the body of a function. The syntax for the Function statement is:

```
[Modifiers] Function FunctionName [(ParameterList)] As ReturnType [Statements]
End Function
```

Where,

- Modifiers: specify the access level of the function; possible values are: Public, Private, Protected, Friend and information regarding overloading, overriding, sharing, and shadowing.
- FunctionName: indicates the name of the function
- ParameterList: specifies the list of the parameters
- ReturnType: specifies the data type of the variable the function returns

Example

Following code snippet shows a function FindMax that takes two integer values and returns the larger of the two.

```
Function FindMax(ByVal num1 As Integer, ByVal num2 As Integer) As Integer
    ' local variable declaration */
    Dim result As Integer
    If (num1 > num2) Then
        result = num1
    Else
        result = num2
    End If
    FindMax = result
End Function
```

Function Returning a Value

In VB.Net, a function can return a value to the calling code in two ways:
- By using the return statement
- By assigning the value to the function name

The following example demonstrates using the FindMax function:

```
Module myfunctions
    'local variables
    Dim i As Integer
    Dim avg As Double
    Dim sum As Integer = 0
    For i = 0 To size - 1
        sum += arr(i)
    Next i
    avg = sum / size
    Return avg
    End Function
    Sub Main()
        ' an int array with 5 elements '
        Dim balance As Integer() = {1000, 2, 3, 17, 50}
        Dim avg As Double
        'pass pointer to the array as an argument
        avg = getAverage(balance, 5)
        ' output the returned value '
        Console.WriteLine("Average value is: {0} ", avg)
        Console.ReadLine()
    End Sub
End Module
```

When the above code is compiled and executed, it produces the following result:
Max value is : 200

Recursive Function

A function can call itself. This is known as recursion. Following is an example that calculates factorial for a given number using a recursive function:

```
Module myfunctions
    Function factorial(ByVal num As Integer) As Integer
        ' local variable declaration */
        Dim result As Integer
        If (num = 1) Then
            Return 1
        Else
            result = factorial(num - 1) * num
            Return result
        End If
    End Function
    Sub Main()
        'calling the factorial method
        Console.WriteLine("Factorial of 6 is : {0}", factorial(6))
        Console.WriteLine("Factorial of 7 is : {0}", factorial(7))
        Console.WriteLine("Factorial of 8 is : {0}", factorial(8))
        Console.ReadLine()
    End Sub
End Module
```

When the above code is compiled and executed, it produces the following result:

```
Factorial of 6 is: 720
Factorial of 7 is: 5040
Factorial of 8 is: 40320
```

Param Arrays

At times, while declaring a function or sub procedure, you are not sure of the number of arguments passed as a parameter. VB.Net param arrays (or parameter arrays) come into help at these times.

The following example demonstrates this:

```
Module myparamfunc
    Function AddElements(ParamArray arr As Integer()) As Integer
        Dim sum As Integer = 0
        Dim i As Integer = 0
        For Each i In arr
            sum += i
        Next i
        Return sum
    End Function
    Sub Main()
        Dim sum As Integer
        sum = AddElements(512, 720, 250, 567, 889)
```

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```vbnet
        Console.WriteLine("The sum is: {0}", sum)
        Console.ReadKey()
    End Sub
End Module
```

Passing Arrays as Function Arguments

You can pass an array as a function argument in VB.Net. The following example demonstrates this:

```vbnet
Module arrayParameter
    Function getAverage(ByVal arr As Integer(), ByVal size As Integer) As Double
        'local variables
        Dim i As Integer
        Dim avg As Double
        Dim sum As Integer = 0
        For i = 0 To size - 1
            sum += arr(i)
        Next i
        avg = sum / size
        Return avg
    End Function
    Sub Main()
        ' an int array with 5 elements '
        Dim balance As Integer() = {1000, 2, 3, 17, 50}
        Dim avg As Double
        'pass pointer to the array as an argument
        avg = getAverage(balance, 5)
        ' output the returned value '
        Console.WriteLine("Average value is: {0} ", avg)
        Console.ReadLine()
    End Sub
End Module
```

When the above code is compiled and executed, it produces the following result:

Average value is: 214.4

> **Activity**
>
> Write a program that will accept marks of a given number of learners. The program must calculate the average mark. Make use of the two functions get Marks() and calculate Average()

VB.Net – Arrays

An array is a set of values, which are termed elements, that are logically related to each other. For example, an array may consist of the number of students in each grade in a programming school; each element of the array is the number of students

in a single grade. Similarly, an array may consist of a student's grades for a class; each element of the array is a single grade.

It is possible for individual variables to store each of our data items. For example, if our application analyses student grades, we can use a separate variable for each student's grade, such as programming Grade1, proramming Grade2, etc. This approach has three major limitations:
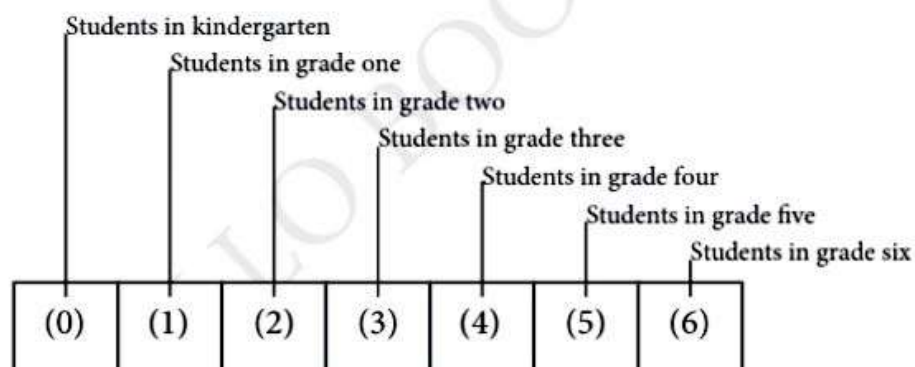
- We have to know at design time exactly how many grades we have to handle.
- Handling large numbers of grades quickly becomes unwieldy. This in turn makes an application much more likely to have serious bugs.
- It is difficult to maintain. Each new grade that we add requires that the application be modified, recompiled, and redeployed.

By using an array, you can refer to these related values by the same name, and use a number that's called an index or subscript to identify an individual element based on its position in the array. The indexes of an array range from 0 to one less than the total number of elements in the array. When you use Visual Basic syntax to define the size of an array, you specify its highest index, not the total number of elements in the array. You can work with the array as a unit, and the ability to iterate its elements frees you from needing to know exactly how many elements it contains at design time.

Array Elements in A Simple Array

Let's create an array named students to store the number of students in each grade in a primary school. The indexes of the elements range from 0 through 6. Using this array is simpler than declaring seven variables. The following illustration shows the students array. For each element of the array:

- The index of the element represents the grade (index 0 represents kindergarten).
- The value that's contained in the element represents the number of students in that grade.

Students in kindergarten
Students in grade one
Students in grade two
Students in grade three
Students in grade four
Students in grade five
Students in grade six

| (0) | (1) | (2) | (3) | (4) | (5) | (6) |

Elements of the "students" array
The following example contains the Visual Basic code that creates and uses the array:

```vb
Imports System.Console
Module ArraysProgram
    Sub Main()
        ' Declare an array with 7 elements.
        Dim students(6) As Integer
        ' Assign values to each element.
        students(0) = 23
        students(1) = 19
        students(2) = 21
        students(3) = 17
        students(4) = 19
        students(5) = 20
        students(6) = 22
        ' Display the value of each element.
        For ctr As Integer = 0 To 6
            Dim grade As String
            s
            WriteLine("Students in {0}: {1}", grade, students(ctr))
        Next
        ReadKey()
    End Sub
End Module
```

The example displays the following output:


```
file:///C:/A Level VB Work/ArraryMarks/ArraryM...   -  □  ×
Students in kindergarten: 23
Students in grade 1: 19
Students in grade 2: 21
Students in grade 3: 17
Students in grade 4: 19
Students in grade 5: 20
Students in grade 6: 22
```

The example does three things:

- It dislayd a students array with seven elements. The number 6 in the array declaration indicates the lastindex in the array; it is one less than the number of elements in the array.
- It assigns values to each element in the array. Array elements are accessed by using the array name and including the index of the individual element in parentheses.
- It lists each value of the array. The example uses a For statement to access each element of the array by its index number.

The students array in the preceding example is a one-dimensional array because it uses one index. An array that uses more than one index or subscript is called multidimensional.

Creating an Array

You can define the size of an array in several ways:

You can specify the size when the array is declared:

```vb
' Declare an array with 10 elements.
Dim cargoWeights(9) As Double
' Declare a 24 x 2 array.
Dim hourlyTemperatures(23, 1) As Integer
' Declare a jagged array with 31 elements.
Dim januaryInquiries(30)() As String
```

You can use a New clause to supply the size of an array when it's created:

```vb
' Declare an array with 10 elements.
Dim cargoWeights() As Double = New Double(9) {}
' Declare a 24 x 2 array.
Dim hourlyTemperatures(,) As Integer = New Integer(23, 1) {}
' Declare a jagged array with 31 elements.
Dim januaryInquiries()() As String = New String(30)() {}
```

If you have an existing array, you can redefine its size by using the *Redim* statement. You can specify that the *Redim* statement keep the values that are in the array, or you can specify that it creates an empty array. The following example shows different uses of the *Redim* statement to modify the size of an existing array.

```vb
' Assign a new array size and retain the current values.
ReDim Preserve cargoWeights(20)
    ' Assign a new array size and retain only the first five values.
ReDim Preserve cargoWeights(4)
    ' Assign a new array size and discard all current element values.
ReDim cargoWeights(15)
```

Storing Values in an Array

You can access each location in an array by using an index of type Integer. You can store and retrieve values in an array by referencing each array location by using its index enclosed in parentheses. Indexes for multidimensional arrays are separated by commas (,). You need one index for each array dimension. The following example shows some statements that store and retrieve values in arrays.

```vb
Imports System.Console
Module ArraysProgram
    Sub Main()
        ' Create a 10-element integer array.
        Dim numbers(9) As Integer
        Dim value As Integer = 2
        ' Write values to it.
        For ctr As Integer = 0 To 9
```

```vb
            numbers(ctr) = value
            value *= 2
        Next
        ' Read and sum the array values.
        Dim sum As Integer
        For ctr As Integer = 0 To 9
            sum += numbers(ctr)
        Next
        WriteLine("The sum of the values is {0}", sum)
        ReadKey()
    End Sub
End Module
```

Populating an array with array literals

By using an array literal, you can populate an array with an initial set of values at the same time that you create it. An array literal consists of a list of comma-separated values that are enclosed in braces ({}). When you create an array by using an array literal, you can either supply the array type or use type inference to determine the array type. The following example shows both options.

```vb
' Array literals with explicit type definition.
Dim numbers = New Integer() {1, 2, 4, 8}
' Array literals with type inference.
Dim doubles = {1.5, 2, 9.9, 18}
' Array literals with explicit type definition.
Dim articles() As String = {"the", "a", "an"}
' Array literals with explicit widening type definition.
Dim values() As Double = {1, 2, 3, 4, 5}
```

When you use type inference, the type of the array is determined by the dominant type in the list of literal values. The dominant type is the type to which all other types in the array can widen. If this unique type can't be determined, the dominant type is the unique type to which all other types in the array can narrow. If neither of these unique types can be determined, the dominant type is Object. For example, if the list of values that's supplied to the array literallycontains values of type Integer, Long, and Double, the resulting array is of type Double. Because Integer and Long widen only to Double, Double is the dominant type.

Iterating through an array

When you iterate through an array, you access each element in the array from the lowest index to the highest or from the highest to the lowest. Typically, use either the For...Next Statement or the For Each...Next Statement to iterate through the elements of an array. When you don't know the upper bounds of the array, you can call the Array.GetUpperBound method to get the highest value of the index. Although lowest index value is almost always 0, you can call the Array.GetLowerBound method to get the lowest value of the index. The following example iterates through a one-dimensional array by using the For...Next statement.

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```vbnet
Module ArraysProgram
    Sub Main()
        Dim numbers = {10, 20, 30, 56, 80}
        For index = 0 To numbers.GetUpperBound(0)
            Console.WriteLine(numbers(index))
        Next
        ReadKey()
    End Sub
End Module
```
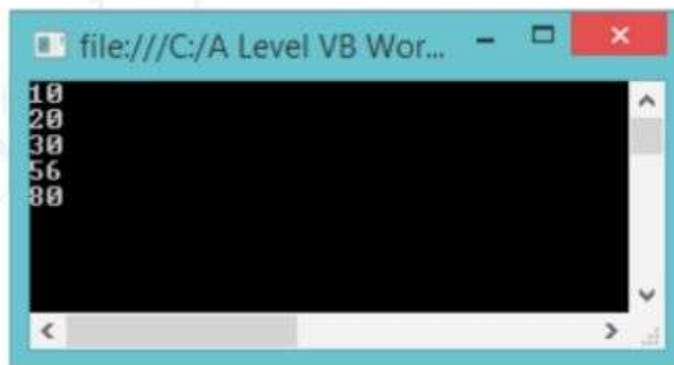

The following example iterates through a multidimensional array by using a For...
Next statement. The GetUpperBound method has a parameter that specifies the
dimension. GetUpperBound(0) returns the highest index of the first dimension,
and GetUpperBound(1) returns the highest index of the second dimension.

```vbnet
Module ArraysProgram
    Sub Main()
        Dim numbers = {{1, 2}, {3, 4}, {5, 6}}
        For index0 = 0 To numbers.GetUpperBound(0)
            For index1 = 0 To numbers.GetUpperBound(1)
                Console.Write(numbers(index0, index1))
            Next
            Console.WriteLine()
        Next
        ReadKey()
    End Sub
```


The following example uses a For Each...Next Statement to iterate through a one-
dimensional array and a two dimensional array.

```vbnet
Imports System.Console
Module ArraysProgram
    Sub Main()
```
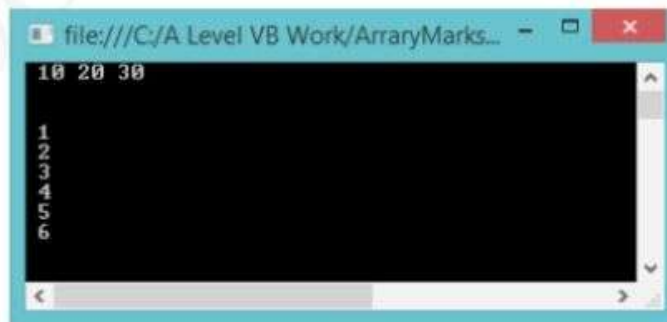
```
' Declare and iterate through a one-dimensional array.
Dim numbers1 = {10, 20, 30}
For Each number In numbers1
    Write(" " & number)
Next
Console.WriteLine()
Dim numbers = {{1, 2}, {3, 4}, {5, 6}}
For Each number In numbers
    WriteLine(number)
Next
ReadKey()
    End Sub
End Module
```


Array Size

The size of an array is the product of the lengths of all its dimensions. It represents the total number of elements currently contained in the array. For example, the following example declares a 2-dimensional array with four elements in each dimension. As the output from the example shows, the array's size is 16 (or $(3 + 1) * (3 + 1)$).

```
Imports System.Console
Module ArraysProgram
    Sub Main()
        Dim arr(3, 3) As Integer
        Console.WriteLine("The size of the array is {0}", arr.Length)
        ReadKey()
    End Sub
End Module
```
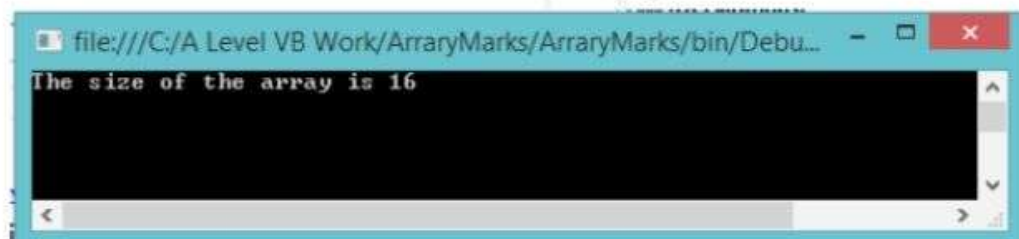

You can find the size of an array by using the Array.Length property. You can find the length of each dimension of a multidimensional array by using the Array.GetLength method. You can resize an array variable by assigning a new array object to it or by using the ReDim Statement. The following example uses the ReDim statement to change a 100-element array to a 51-element array. There are several things to keep in mind when dealing with the size of an array.

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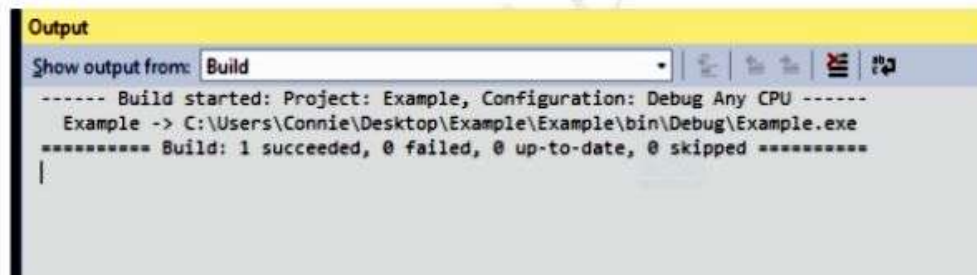|	
Dimension Length	The index of each dimension is 0-based, which means it ranges from 0 to its upper bound. Therefore, the length of a given dimension is one greater than the declared upper bound of that dimension.
Length Limits	The length of every dimension of an array is limited to the maximum value of the Integer data type, which is Int32.MaxValue or $(2 \wedge 31) - 1$. However, the total size of an array is also limited by the memory available on your system. If you attempt to initialize an array that exceeds the amount of available memory, the runtime throws an Out Of Memory Exception.
Size and Element Size	An array's size is independent of the data type of its elements. The size always represents the total number of elements, not the number of bytes that they consume in memory.
Memory Consumption	It is not safe to make any assumptions regarding how an array is stored in memory. Storage varies on platforms of different data widths, so the same array can consume more memory on a 64-bit system than on a 32-bit system. Depending on system configuration when you initialize an array, the common language runtime (CLR) can assign storage either to pack elements as close together as possible, or to align them all on natural hardware boundaries. Also, an array requires a storage overhead for its control information, and this overhead increases with each added dimension.

Building and debugging programs

After writing a program it has be built. Building of a program is the checking of compiler errors by the compiler. If the program successfully builds up it means it will be free from compiler errors. To build a program click the Build tab on the ribbon of the Visual studio IDE:
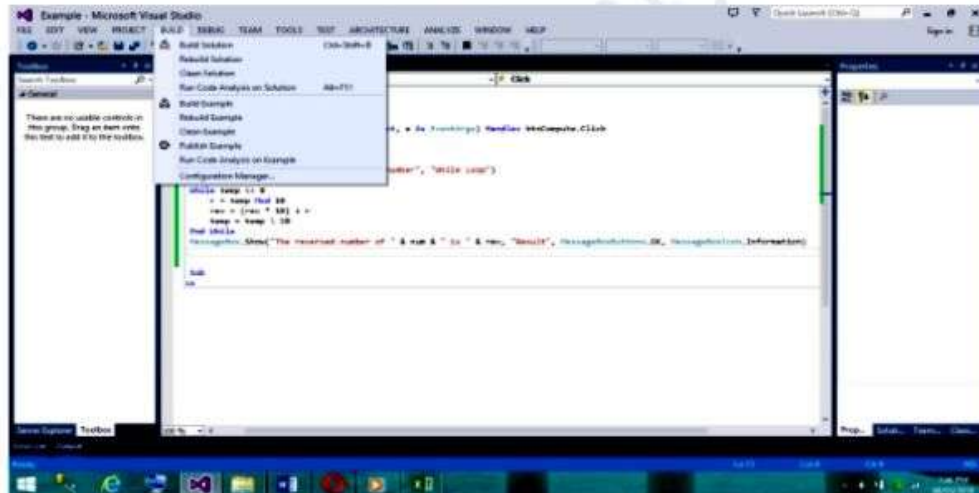
If it is the first time it is wiser to select the Build Solution option but if it is not, then you can select Rebuild Solution. If the program is built successfully the following interface will appear below the code:


```
Output
Show output from: Build                                  ▼ | ⚞ | ⤒ ⤓ | ⅀ | ⟲
------ Build started: Project: Example, Configuration: Debug Any CPU ------
  Example -> C:\Users\Connie\Desktop\Example\Example\bin\Debug\Example.exe
========== Build: 1 succeeded, 0 failed, 0 up-to-date, 0 skipped ==========
|
```

It will state the number of projects passed the build process, those failed, those up-to-date (which does not need build) and any skipped. It will show the path where the executable file will be stored.

Debugging

After a successful build, the program can then be run which is known as debugging in Visual Studio by clicking the green start button or Debug tab then the Start Debugging. If it happens that the program was not built before debugging, when you click start debugging, the compiler will first build it and then run the project. This is what most people do since they know that the compiler will built the program and then start the debugging.

> **Activity/Research**
> In pairs, write a program that will accept two numbers from the keyboard. The program must add the numbers using a function. Finally, the program should display the result.

End of chapter questions

1. Outline the forms of the following control structures in Visual Basic.Net through examples
   a. Decision Making
      i. If…Then...Else Statement   [5 marks]
      ii. Select Case…. End Select.   [5 marks]

2. Differentiate between the following
   a. Building and Debugging a program in Visual Basic.Net   [2 marks]
   b. While…End While and Do… Loop   [4 marks]

3. Which of the following statements about the array are not true?
   a. To use an array, previously it is declared and defined.
   b. A one-dimensional array can store data in the form of a table with many rows and
         columns.
   c. The position of every element of the array is used to access that element and position.
   d. A one-dimensional array can store different types of data

4. In VB.NET, when an array is partially initialized, the rest of its elements will automatically
   be set to zero.
   a. True   b. False

5. Dim count As Integer = 2
   Do
   MessageBox.Show("VB.NET")
   count = count + 2
   Loop While count > 10
   How many times will the MessageBox.Show method in the code above be processed?
   A. 1   B. 4   C. 5   D. 10

6. Dim IntArray(5) As Integer
   How many elements in IntArray?
    A. 4   B. 5   C. 6   D. None of above

7. Dim num() as Integer ={1, 2, 3, 4, 5,6,7,8}
   Which of the following values stored in the num(5).
   A. 4   B. 5   C. 6   D. None of above

8. Consider the following Visual Basic code. Answer the following question basing thr on the
   code below.
   ```
   Dim state() As String = {"Malaysia", "Singapore", "Thailand", "United America"}
   Dim phoneNum() As String = {"1-800-999-9998", "1-800-999-8006", "1-800-999-6709"}
   phoneNum(1) = phoneNum(1).Replace("800", "877") (a)
   Mid(state(3), 8) = "Kindom"
   displayLabel.Text = state(3) (b)
   ```

a. What is the latest value for phoneNum(1) after we execute statement (a)   (2 Marks)
b. Write the Visual Basic code that uses the Like operator to determine whether any elements in the state array contains a string that begins with letter N then end with letter k. If found, then display that element in statusLabel, otherwise, display "Not Found" (10 Marks)
c. What is the output of state(3) in statement (b)?   (2 Marks)
d. Write the Visual Basic code to show the string length for state(3).   (2 Marks)
e. What is the output for the code Array.Reverse(state) after statement (b)   (2 marks)
f. Write a statement to declare an integer type two dimensional array namely Table. The Table array consist of 3 row elements and 2 column elements.   (2 marks)

Midyear Examinations

1. Which of the following instructional strategies would be most appropriate for introducing computer programming students to the concept of algorithms?
   A. explaining how the efficiency of an algorithm can be determined
   B. using a flowchart that describes the steps for baking a cake as an analogy for an algorithm
   C. providing students with a step-by-step explanation of an algorithm written in pseudocode
   D. demonstrating the operation of a sorting algorithm using a computer connected to a projector

2. A Robot is a
   A. Programmable
   B. Multi functional manipulator
   C. Both (A) and (B)
   D. None of the above

3. The main objective(s) of Industrial robot is to
   A. To minimise the labour requirement
   B. To increase productivity
   C. To enhance the life of production machines
   D. All of the above

4. On the feasibility committee, department representatives serve as:
   A. liaison to their departments
   B. ready sources of information
   C. direct users of the new system
   D. All of the above

5. A feasibility document should contain all of the following except :
   A. project name
   B. feasible alternative
   C. dataflow diagrams
   D. problem description

6. A Pseudocode is
   A. a flow chart
   B. a random number
   C. a machine - level code
   D. structured English to communicate the logic of a program

7. A feasibility study
   A. considers a single solution

B. includes a statement of the problems
C. a list of alternative solution considered
D. None of the above

8. A word processor designed for programmers is called
   A. An editor
   B. A compiler
   C. A formatter
   D. A debugger

9. During the system study, analysts determine manager's information needs by
   A. asking questions
   B. showing samples of computer reports
   C. conducting tours of a nearby computer center
   D. teaching short courses in programming languages

10. After planning an algorithm, you should _____ to verify that it will work correctly.
    A. Code the algorithm
    B. Analyze the algorithm
    C. Desk-check the algorithm
    D. Evaluate and modify (if necessary) the program

11. The first step in the problem-solving process is to _____.
    A. Plan the algorithm
    B. Analyze the problem
    C. Code the algorithm
    D. Evaluate and modify (if necessary) the program

12. It is necessary to carry out a feasibility study as
    A. top management can not ensure that a project is feasible before calling a system ana-lyst
    B. top management is not sure what they want from the System Analysis and Design
    C. even though top management is in favor of the system, technology may not be mature for implementation
    D.. all organizations do it

13. Feasibility study is carried out by
    A. managers of the organization
    B. system analyst in consultation with managers of the organization
    C. users of the proposed system
    D. systems designers in consultation with the prospective users of the system

14. What type of software is antivirus software?
    A. System software

    B. Utility software

    C. Application software

    D. Operating systems

15. Most applications of robotics are used in the area of

    A. cooking

    B. manufacturing

    C. teaching

    D. farming

16. Example of automatic programmable machine is

    A. ATM

    B. ROBOT

    C. CAD

    D. CAM

17. _____ software, such as operating systems and utility programs, consists of the programs that control or maintain the operations of a computer and its devices.

    A. System

    B. Application

    C. Management

    D. Program

18. Two types of Networks are :

    A. WAN and LA

    B. WAN and LAN

    C. TAN and CAN

    D. All of the above

19. C++ is a Programming Language

    A. True

    B. False

20. ISP Stands for Internet Service Provider

    A. True

    B. False

Structured questions

1. Five statements about serial half-duplex data transmission are shown in the table below. Tick () to show whether each statement is true or false. (5)

Statement	true ()	false ()
Data is transmitted in one direction only, one bit at a time.		
Data is transmitted in both directions, multiple bits at a time.		
Data is transmitted in one direction only, multiple bits at a time.		
Data is transmitted in both directions, but only one direction at a time.		
Data is transmitted one bit at a time.		
Data is transmitted multiple bits at a time.		

2. Computer A is communicating with computer B.

   a. Draw an arrow or arrows to show simplex, duplex and half-duplex data transmission. The direction of the data transmission must be fully labelled. (6)

Simplex data transmission
Computer A   Computer B

Duplex data transmission
Computer A   Computer B

Half-duplex data transmission
Computer A   Computer B

(b). State a use for the following data transmission methods. The use must be different for each data transmission method. Simplex ....

....
.... Duplex ....
....
.... [2]

3. Give two other uses of hexadecimal.

   Use 1 ....
   ....
   Use 2 ....
   .... [2]

4. 4. (a) Viruses, pharming and phishing are all examples of potential Internet security issues.
   Explain what is meant by each of these three terms. Virus ....
   ....
   ....
   ....
   ....

   Pharming ....
   ....
   ....
   ....

   Phishing ....
   ....
   ....
   .... [6]

5. A database, STAFFPHONE, was set up to show the telephone extension numbers for members of staff working in a department store.

Name	Department	Extension number
Jane	Smith Toys	129
Sue Wong	Books	124
David Chow	Toys	129
Amy Tang	Household	123
Joe Higgs	Books	124
Jane Smith	Shoes	125
Adel Abur	Shoes	125
Peter Patel	Toys	129

6. For the tasks listed below, write down the most suitable type of application software package. [4] Task   Application software package

Chapter 9
Database

In this chapter you will learn about:
- Developing databases using database objects and views
- Edit database objects
- Apply database security

Database

A database is a structured collection of related records. Database consists of columns (attributes) and rows (records). Databases allow their users to enter, access, and analyze their data quickly and easily. They're such a useful tool that you see them all the time. Ever waited while a doctor's receptionist entered your personal information into a computer, or watched a store employee use a computer to see whether an item was in stock? If so, then you've seen a database in action.

In this chapter special reference to a database called Microsoft Access (or simply Access) will be made. In Access, all data is stored in tables, which puts tables at the heart of any database.

Database object

A database object is any defined object in a database that is used to store or reference data. Some examples of database objects include tables, views, queries, forms, and reports, clusters, sequences, indexes, and synonyms.

In this chapter, you will learn about new database objects called database view, tables, queries, forms and reports. We will discuss the advantages and disadvantages of using the objects.

Tables

Tables store raw data that is the backbone of the entire database system. Tables are often related to other tables in the file. A table is used to organize the information into rows and columns.

Example – A Customer table contains information such as customer id, First name, Last name, and so on as a series of columns.

ID	First Name	Last Name	Street Addre
1	Tomonyo	Madziwa	Tahoma Street
2	Kundai	Chirwa	Nyemba Street
3	Munashe	Gotora	Ruva Street
4	Mufaro	Chaka	Tembo Street
5	Tinashe	Mbambo	Mombe Street
6	Tadiwa	Gunda	Jongwe Street
7	Ruva	Chepo	Ramba Street
8	Chido	Zimunya	Tura Street
9	Paida	Moyo	Rudo Street
10	Munetsi	Munetsi	Tate Street
11	Rujeko	Mutudza	Zviko Street
12	Farai	Shumba	Gwara Street

Rows and columns are referred to as records and fields. A field is more than just a column; it's a way of organizing information by the type of data it is . Every piece of information within a field is of the same type. For example, every entry in a field called First Name would be a name, and every entry in a field called Street Address would be an address as shown in the table above.

A record is more than just a row; it's a unit of information. Every cell in a given row is part of that row's record as shown below.

ID	First Name	Last Name	Street Addre	Add New Field
1	Tomonyo	Madziwa	Tahoma Street	
2	Kundai	Chirwa	Nyemba Street	
3	Munashe	Gotora	Ruva Street	
4	Mufaro	Chaka	Tembo Street	
5	Tinashe	Mbambo	Mombe Street	
6	Tadiwa	Gunda	Jongwe Street	
7	Ruva	Chepo	Ramba Street	
8	Chido	Zimunya	Tura Street	
9	Paida	Moyo	Rudo Street	
10	Munetsi	Munetsi	Tate Street	
11	Rujeko	Mutudza	Zviko Street	
12	Farai	Shumba	Gwara Street	

See the number at the left of each row? It's the ID number that identifies each record. The ID number for a record refers to every piece of information contained on that row and it is unique for that record. This means throughout the table you will not see a similar ID. This is called primary key. So a primary key is that uniquely identifies a record.

The above tables show that databases store information that is closely related.

Views

A view is a way of portraying information in the database. This can be done by arranging the data items in a specific order, by highlighting certain items, or by showing only certain items. For any database, there are a number of possible views that may be specified.
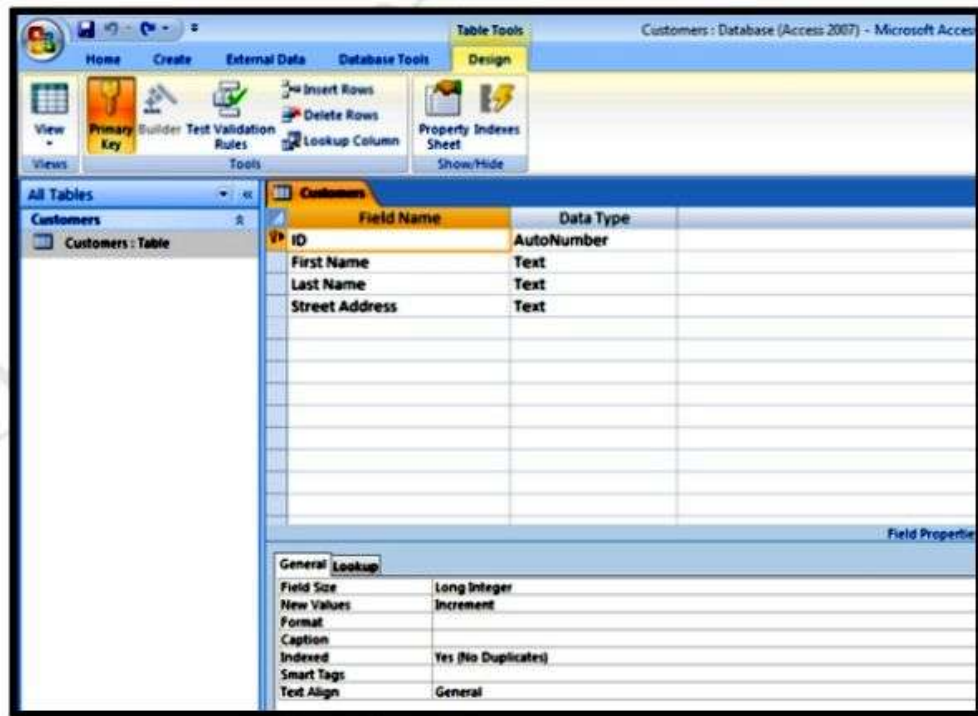
1. Datasheet view

To view, change, insert, or delete data in a table within Access, you can use the table's Datasheet View. It is the typical grid-style view used for seeing and editing data as shown below. Datasheet view shows the data in the database.. It does not let you change the format of the database, other than minor changes (such as displayed column widths).

2. Design view

Design view allows you to create or change the table, form, or other database object, and configure the fields. You can also set keys and restrict the values entered here. But you can't change the database data in design view.

You don't use one or the other exclusively. You constantly switch back and forth between them while designing your database. Use the View button to switch between datasheet view and design view.

- In design view, clicking the View button switches you to datasheet view.
- In datasheet view, clicking the View button switches you to design view.
- You can select other views with its dropdown arrow. It is probably the most used button on the toolbar.

Forms

- Forms display live data from the tables for data entry or edit. They are sometimes called "screens" or "user interface."
- You likely have had to fill out forms on many occasions, like when visiting a doctor's office, applying for a job, or registering for school.
- Forms are an easy way to guide people toward entering data correctly.
- When you enter information into a form in Access, the data goes exactly where the database designer wants it to go.

Queries

- Queries are a way of searching for and compiling data from one or more tables.
- Queries answer a question by selecting and sorting data for you based on what you want to know. For example, a query can tell you "how many girls are there in this class"
- Queries are far more powerful than the simple searches you might carry out within a table.
- While a search would be able to help you find the name of one student in your class, you could run a query to find the name and age of every student who's paid their fees within the past week.
- A well-designed query can give information you might not be able to find just by looking through the data in your tables.
- Using the Customer table above we want to find out the number of customers with surnames that starts with M. The query will be as shown below:

Reports

- Reports display data in pre-formatted templates for printing or display.
- Data cannot be edited in reports. It must be edited through in data entry, prior to running the report.
- Your end of term or year printed reports or printed invoice of a purchase, are examples of database reports.
- Reports are useful because they allow you to present components of your database in an easy-to-read format.
- You can even edit a report's appearance to make it visually appealing. Access offers you the ability to create a report from any table or query.

How the objects work together

Even if you have a good idea of how each object can be used, it can initially be difficult to understand how they all work together. It helps to remember that they all work with the same data. Every piece of data a query, form, or report is stored in one of your database tables.

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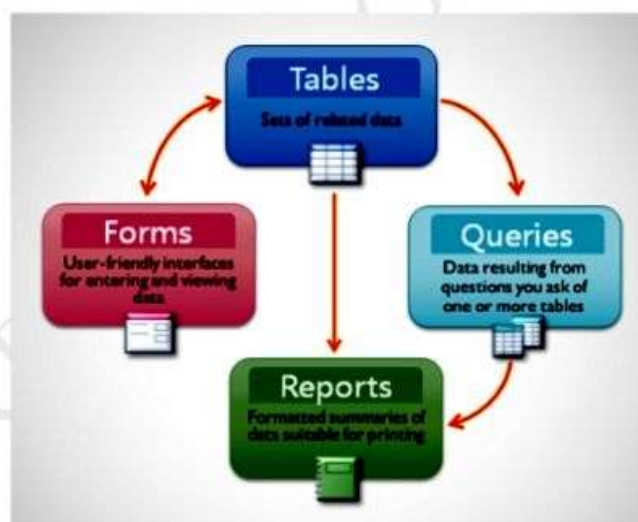
Data Manipulation Language (DML)

Data Manipulation Language (DML) is a family of computer languages used to retrieve, insert, delete and update data in a database. These statements are used to manipulate the data in records.

Currently the most popular data manipulation language is that of SQL, which is used to retrieve and manipulate data in a Relational database.

Commonly used DML statements are:

SELECT - Retrieve data from the a database

INSERT - Insert data into a table

UPDATE - Updates existing data within a table

DELETE - Deletes all records from a table, the space for the records remain . For example the command.

DELETE from CUSTOMERS WHERE firstName = 'Moyo'

The above command will delete all records in the CUSTOMERS table with the last name Moyo.

There are two types of DML:
Procedural: The user specifies what data is needed and how to get it.
Non-Procedural: The user only specifies what data is needed.

Database security

- The use of information security controls is to protect databases against compromises of their confidentiality, integrity and availability.
- Involves various types of controls, such as technical, procedural/administrative and physical.

Security risks to database systems include, for example:

- unintended activity or misuse by authorized database users, database administrators, or network/systems managers, or by unauthorized users or hackers (e.g. inappropriate access to sensitive data, metadata or functions within databases, or inappropriate changes to the database programs, structures or security configurations);
- Malware infections causing incidents such as unauthorized access, leakage or disclosure of personal or proprietary data, deletion of or damage to the data or programs, interruption or denial of authorized access to the database, attacks on other systems and the unanticipated failure of database services;
- Overloads, performance constraints and capacity issues resulting in the inability of authorized users to use databases as intended;
- Physical damage to database servers caused by computer room fires or floods,

overheating, lightning, accidental liquid spills, static discharge, electronic breakdowns/equipment failures and obsolescence;

- Design flaws and programming bugs in databases and the associated programs and systems, creating various security vulnerabilities (e.g. unauthorized privilege escalation), data loss/corruption, performance degradation etc.;
- Data corruption and/or loss caused by the entry of invalid data or commands, mistakes in database or system administration processes, sabotage/criminal damage etc.

1. Put strong passwords

Strong passwords are the easiest thing you can do to strengthen your security. Avoid using: any personal data (such as your birth date), common words spelled backwards and sequences of characters or numbers, or those that are close together on the keyboard.

2. Put up a strong firewall

A firewall is a software that protects your network by controlling internet traffic coming into and flowing out of your business.

3. Install antivirus protection

"They're the last line of defense" should an unwanted attack get through t o your network.

4. Update your programs regularly

Frequently updating your programs keeps you up-to-date on any recent issues or holes that programmers have fixed.

5. Secure your laptops

e.g by encrypting them. Encryption software changes the way information looks on the harddrive so that, without the correct password, it can't be read.

6. Backup regularly

Scheduling regular backups to an external hard drive, or in the cloud, is a painless way to ensure that all your data is stored safely.

7. Monitor diligently

If you don't monitor things, it's a waste of time and a waste of resources. You won't know that you've been compromised until it's far too late.

8. Be careful with e-mail, IM and surfing the Web

Avoid randomly clicking on links or download an attachment that may appear harmless because you may discover that you have been infected with a nasty virus, or worse

9. Educate your peers

teaching your peers about safe online habits and proactive defense is crucial.

Activity/Research
In pairs, discuss database security controls.

End of chapter questions

1. 1. SQL stands for _____ (1)
    A. Structured Query Language
    B. Sequential Query Language
    B. Structured Question Language
    C. Sequential Question Language

2. Which object is used to create a form? (1)
    A. Tables and Queries
    B. Tables only
    C. Tables and reports
    D. Queries and reports

3. What determines a table's sort order? (1)
    A. AutoNumber
    B. Index field
    C. Field order
    D. Primary key

4. What is the intersection of a row and a column? (1)
    A. Form
    B. Cursor
    C. Cell
    D. Record

5. Which tool do you use to create a query object? (1)
    A. Database wizard
    B. Simple filter wizard
    C. Simple query wizard
    D. Table query wizard

6. Which of the following is not a view for interacting with a form object? (1)
    A. Datasheet view
    B. Design view
    C. Form view
    D. Layout view

7. What is the result of 'Select * from CUSTOMER where CustID>10 and CustID<100' query? (2)
    A. Display all customers with CustID from 10 to 100
    B. Display all customers with CustID above 10
    C. Display all customers with CustID below 100
    E. Display all customers with CustID from 11 to 99

8. Which statement deletes the rows where the employee's phone number is not entered? (1)

   f.   DELETE FROM Employee
       WHERE Phone IS NULL

   g.   DELETE FROM Employee
       WHERE Phone IS NOT NULL

   h.   DELETE FROM Employee
       WHERE Phone = '&'

   i.   DELETE FROM Employee
       WHERE Phone = NULLABLE

9. What is a view in database (2)

10. What are DML statements in SQL. (2)

11. Which SQL command is used to add a row? (2)

12. Write the command to remove all customers named Ruva from the CUSTOMERS table.

13. What are the differences between primary and foreign keys? (2

Chapter 10
Web Designing

In this chapter you will learn about
- Content Management System
- Customise Websites
- Generate content using Graphics design package
- Apply the concept of debugging and testing
- Use Plugins an extensions in web development

What is a Content Management System (CMS)?

- A Content Management System (CMS) is a Web application that uses a database (usually MySQL) or other methods to create, edit, and store HTML content in a manageable way.
- Content is created and edited on the web in an administration portion of the web application (referred to as the Backend).
- The resulting content is then displayed to the viewers on the regular site (referred to as the Frontend).
- It is an open source meaning it was found for free on the internet and anyone can use it for free.
- Many web developers are now using CMS to build websites.

The following pictures show different types of CMS that you can find on the internet:

What to Look for in a CMS
There are many things to look for in a Content Management System but here are a few of the more important ones:
1. Quick and easy installation
2. Simple administration interface

3. Quick and easy extension of CMS for extra functionality
4. Simple template manipulation
5. Helpful user community

Examples of CMS templates (interfaces)

Drupal

- Drupal is easily the most functional open source CMS available today.
- It allows for the editing of content directly on the page, and is easily extended through the use of modules.
- Themes can be developed easily with CSS and though it has a few issues, it is the least frustrating CMS available.

Wordpress

- WordPress began as a simple blogging system but has grown into one of the most powerful CMS's on the Internet.
- The administration interface which has become so easy to use for millions of bloggers translates over to extended versions of WordPress.
- It is a user friendly CMS, many plugins and extensions have been produced.

Joomla

- Joomla! is a popular open source (free) content management system (CMS).
- With Joomla you can run and manage your own website with the minimum of fuss.
- Lots of organisations use Joomla! including large businesses and governments.

To get any of these free softwares you simply need to download them from the internet and start using them. It is important to choose a CMS which suits your requirements.

Hypertext Markup Language HTML

HTML stands for Hypertext Markup Language, and it is the most widely used language to write Web Pages.

- Hypertext refers to the way in which Web pages (HTML documents) are linked together. Thus, the link available on a webpage is called Hypertext.
- As its name suggests, HTML is a Markup Language which means you use HTML to simply "mark-up" a text document with tags that tell a Web browser how to structure it to display.

To start writing in HTML, you can use a simple text editor like notepad. (Usually found under the Programs > Accessories menu)
Type this into your text editor:

This is my first web page

Now create a folder called "html" wherever you like to save files on your computer and save the file as "myfirstpage.html".

Be careful. It is important that the extension ".html" is specified - some text editors, such as Notepad, will automatically save it as ".txt" otherwise.

You also need to ensure that your file is being saved as plain text. TextEdit, for example, will start new files as "Rich text", containing lots of formatting extras, by default. In such cases, go into the preferences and make sure you check the "Plain text" format option before creating a new file.

View html file

To look at HTML files, they don't even need to be on the web. Open a web browser such as Chrome, Firefox, Safari or Internet Explorer and in the address bar, where you usually type web addresses, type in the location of the file you just saved (for example, "c:\html\myfirstpage.html") and press enter.

Alternatively, go to the File menu of the browser, select Open, and browse for the file. Can you see your first web page. How exciting. And all it took was a few typed words! Although the basics of HTML is plain text, we need a bit more to make it a nice and shiny HTML document.

Tags

The basic structure of an HTML document includes tags, which surround content and apply meaning to it.
Change your document so that it looks like this:

```
<!DOCTYPE html>
<html>
<body>
   This is my first web page
</body>
</html>
```

Now save the document again, go back to the web browser and reload the page.
The appearance of the page will not have changed at all, but the purpose of HTML is to apply meaning, not presentation, and this example has now defined some fundamental elements of a web page.

- The first line on the top, <!DOCTYPE html>, is a document type declaration and it lets the browser know which flavor of HTML you're using (HTML5, in this case).
- <html> is the opening tag that kicks things off and tells the browser that

everything between that and the </html> closing tag is an HTML document.

- The stuff between <body> and </body> is the main content of the document that will appear in the browser window.

Closing tags

The </body> and </html> put a close to their respective elements

Not all tags have closing tags like this (<html></html>) some tags, which do not wrap around content will close themselves.

The line-break tag for example, looks like this :
 - a line break doesn't hold any content so the tag merrily sits by its lonely self.

Take note : All tags with content between them should be closed, in the format of opening tag → content → closing tag.

Attributes

An attribute is used to define the characteristics of an HTML element and is placed inside the element's opening tag. All attributes are made up of two parts – a name and a value

- The name is the property you want to set. For example, the paragraph <p> element in the example carries an attribute whose name is align, which you can use to indicate the alignment of the paragraph on the page.
- The value is what you want the value of the property to be worth and always put within quotations. The below example shows three possible values of align attribute: left, center and right.

Attribute names and attribute values are case-insensitive. However, the World Wide Web recommends lowercase attributes/attribute values in their HTML for recommendation.

```
<!DOCTYPE html>
<html>
<head>
  <title>My first web page</title>
</head>
  <Body>
   <p align = "left> This is left aligned</p>
   <p align = "left> This is left aligned</p>
   <p align = "left> This is left aligned</p>
  </Body>
</html>
```

This will display the following result –

This is left aligned		
	This is center aligned	
		This is right aligned

Elements

Elements are the bits that make up web pages. Elements start with an opening tag, followed by content, and lastly a closing tag. An example is given below.

Start Tag	Content	End Tag
<p>	This is paragraph content.	</p>
<h1>	This is heading content.	</h1>
<div>	This is division content.	</div>

So here **<p>....</p>** is an HTML element, **<h1>...</h1>** is another HTML element. There are some HTML elements which don't need to be closed, such as **<img.../>**, **<hr />** and **
** elements. These are known as void elements.

<title>

The <title> tag is used inside the <head> tag to mention the document title. The <title> tag is required in all HTML documents and it defines the title of the document. The <title> element:

- defines a title in the browser toolbar
- provides a title for the page when it is added to favorites
- displays a title for the page in search-engine results

To add a title to your page, change your code so that it looks like this:

```
<!DOCTYPE html>
<html>
<head>
  <title>My first web page</title>
</head>
<body>
  This is my first web page
</body>
</html>
```

We have added two new elements here, the head tag and the title tag. The head element The information in the head element does not appear in the browser window.

If you look at this document in the browser after saving and reloading you will see that "My first web page" will appear on a tab or the title bar of the window .
The text that you put in between the title tags has become the title of the document. If you were to add this page to your "favorites" folder, you would see that the title is also used there.

<p> tag

This tag represents a paragraph.

Go back to your text editor and add another line to your page:

```
<!DOCTYPE html>
<html>
<head>
  <title>My first web page</title>
</head>
<body>
  This is my first web page
  I am enjoying
</body>
</html>
```

Look at the document in your browser.

You might have expected your document to appear as you typed it, on two lines, but instead you should see something like this:

This is my first web page I am enjoying.

This is because web browsers don't usually take any notice of what line your code is on. It also doesn't take any notice of spaces (you would get the same result if you typed "This is my first web page   I am enjoying").

If you want text to appear on different lines change your two lines of content so that they look like this:

```
<p>This is my first web page</p>
<p>I am enjoying</p>
```

The p tag is used for paragraphs.

The two lines will now appear on two lines because the browser recognizes them as separate paragraphs.

Line breaks

The line-break tag can also be used to separate lines like this:

This is my first web page

I am enjoying

There's no content involved in breaking lines so there is no closing tag.

Headings

The <h> is used for headings.

They are h1, h2, h3, h4, h5, h6. H1 is the largest heading and h6 is the lowest as depicted in the following code.

<h1>Heading level 1</h1>

```
<h2>Heading level 2</h2>
<h3>Heading level 3</h3>
<h4>Heading level 4</h4>
<h5>Heading level 5</h5>
<h6>Heading level 6</h6>
```

This will produce the following output

Change your code to the following:

```
<!DOCTYPE html>
<html>
<head>
  <title>My first web page</title>
</head>
<body>
  <h1>My first web page</h1>
  <h2>What this is</h2>
  <p>A simple page put together using HTML</p>
  <h2>Why this is</h2>
  <p>To learn HTML</p>
</body>
</html>
```

Take note: The h1 tag is only used once, as the main heading of the page while h2 to h6, can be used as often as desired, but they should always be used in order, as they were intended. For example, an h4 should be a sub-heading of an h3, which should be a sub-heading of an h2.

Lists

HTML offers web authors three ways for specifying lists of information. All lists must contain one or more list elements. Lists may contain –

- `<ul>` – An unordered list. This will list items using plain bullets.
- `<ol>` – An ordered list. This will use different schemes of numbers to list your items.
- `<dl>` – A definition list. This arranges your items in the same way as they are arranged in a dictionary.

Change your code to the following:

```
<!DOCTYPE html>

<html>

<head>
  <title>My first web page</title>
</head>

<body>
  <h1>My first web page</h1>

  <h2>What this is</h2>
  <p>A simple page put together using HTML</p>

  <h2>Why this is</h2>
  <ul>
    <li>To learn HTML</li>
    <li>To Teach</li>
    <li> Because I've found this HTML interesting </li>
  </ul>

</body>

</html>
```

If you look at this in your browser, you will see a bulleted list. Simply change the ul tags to ol and you will see that the list will become numbered.
Lists can also be included in lists to form a structured hierarchy of items.
Replace the above list code with the following:

```
<ul>
  <li>To learn HTML</li>
  <li>
```

```
    To Teach
    <ol>
      <li>My father Prince</li>
      <li>My friend Ruvimbo</li>
      <li>My mother Mufaro</li>
      <li>My sibling Mutsa</li>
    </ol>
  </li>
  <li>Because I've found this HTML interesting.</li>
</ul>
```

Links

So far you've been making a stand-alone web page, which is all very well and nice, but what makes the Internet so special is that it all links together.

A webpage can contain various links that take you directly to other pages and even specific parts of a given page. These links are known as hyperlinks.

Hyperlinks allow visitors to navigate between Web sites by clicking on words, phrases, and images. Thus you can create hyperlinks using text or images available on a webpage.

The "H" and "T" in "HTML" stand for "hypertext", which basically means a system of linked text.

Linking Documents

A link is specified using HTML tag <a>. This tag is called anchor tag and anything between the opening <a> tag and the closing tag becomes part of the link and a user can click that part to reach to the linked document. Following is the simple syntax to use <a> tag.
 Add this to your document:

```
<!DOCTYPE html>

<html>

<head>
  <title>My first web page</title>
</head>

<body>

  <h1>My first web page</h1>

  <h2>What this is</h2>
  <p>A simple page put together using HTML</p>
```

```
<h2>Why this is</h2>
<p>To learn HTML</p>

   <h2>Where to find the tutorial</h2>
<p><a href="http://www.htmllearning.com">HTML Learning</a></p>

</body>

</html>
```

This will produce the following result

Images

Images are very important to beautify as well as to depict many complex concepts in simple way on your web page. This tutorial will take you through simple steps to use images in your web pages.

Insert Image

You can insert any image in your web page by using <img> tag. Following is the simple syntax to use this tag.

```
<img src = "Image URL" ... attributes-list/>
```

The <img> tag is an empty tag, which means that, it can contain only the list of attributes and it has no closing tag.

```
<!DOCTYPE html>

<html>

<head>
  <title>My first web page</title>
</head>

<body>

  <h1>My first web page</h1>

  <h2>What this is</h2>
  <p>A simple page put together using HTML</p>

  <h2>Why this is</h2>
  <p>To learn HTML</p>
  <p>Simple image insert</p>
<img src = "C:\Program Files (x86)\Microsoft Office\MEDIA\CAGCAT10\
j0195384.wmf " alt = "Computer Image">

  <h2>Where to find the tutorial</h2>
  <p><a href="http://www.htmllearning.com">HTML Learning</a></p>

</body>

</html>
```

The most commonly used file formats for images are JPEGs, GIFs, and PNGs. They are compressed formats, and have very different uses.
A JPEG (pronounced "jay-peg") uses a mathematical algorithm to compress the image and will distort the original slightly. The lower the compression, the higher the file size, but the clearer the image.

JPEGs are typically used for images such as photographs.

A GIF (pronounced "jif") can have no more than 256 colors, but they maintain the colors of the original image. The lower the number of colors you have in the image, the lower the file size will be. GIFs also allow any pixel in the image to be transparent.

GIFs are typically used for images with solid colors, such as icons or logos.

A PNG (pronounced "ping") replicates colors, much like a GIF, but allows 16 million colors as well as alpha transparency (that is, an area could be 50% transparent).

Tables

The HTML tables allow web authors to arrange data like text, images, links, other tables, etc. into rows and columns of cells.

The HTML tables are created using the <table> tag in which the <tr> tag is used to create table rows and <td> tag is used to create data cells. The elements under <td> are regular and left aligned by default

Copy the following code into the body of your document and then we will go through what each tag is doing:

```
<table>
  <tr>
    <td>Row 1, cell 1</td>
    <td>Row 1, cell 2</td>
    <td>Row 1, cell 3</td>
  </tr>
  <tr>
    <td>Row 2, cell 1</td>
    <td>Row 2, cell 2</td>
    <td>Row 2, cell 3</td>
  </tr>
  <tr>
    <td>Row 3, cell 1</td>
    <td>Row 3, cell 2</td>
    <td>Row 3, cell 3</td>
  </tr>
  <tr>
    <td>Row 4, cell 1</td>
    <td>Row 4, cell 2</td>
    <td>Row 4, cell 3</td>
  </tr>
</table>
```

- The table element defines the table.
- The tr element defines a table row.
- The td element defines a data cell. These must be enclosed in tr tags, as shown above.
- If you imagine a 3x4 table, which is 12 cells, there should be four tr elements to define the rows and three td elements within each of the rows, making a total of 12 td elements.

- Table cells which act as column headers or row headers should use the <th> (table header) element.
- Table cells can be merged using the colspan and rowspan attributes.
- Tables can be broken into sections using the following elements:

    o   <thead> — Table header
    o   <tbody> — Table body
    o   <tfoot> — Table footer

Copy the following code and it should produce the output below.

```
<table>
    <tr>
            <th>Name</th>
            <th>Favorite Color</th>
    </tr>
    <tr>
            <td>Takudzwa</td>
            <td>2A</td>
    </tr>
    <tr>
            <td>Mufarowashe</td>
            <td>2B</td>
    </tr>
</table>
```

Output of the above code.

Name	Class
Takudzwa	2A
Mufarowashe	2B

Forms

HTML Forms are required, when you want to collect some data from the site visitor. For example, during user registration you would like to collect information such as name, email address, credit card, etc.

A form will take input from the site visitor and then will post it to a back-end application such as CGI, ASP Script or PHP script etc. The back-end application will perform required processing on the passed data based on defined business logic inside the application.

There are various form elements available like text fields, text area fields, drop-down menus, radio buttons, checkboxes, etc.

The HTML <form> tag is used to create an HTML form and it has the following

syntax :

```
<form action = "Script URL" method = "GET|POST">
  form elements like input, textarea etc.
</form>
```

Form Attributes

Apart from common attributes, following is a list of the most frequently used form attributes –

Sr.No   Attribute & Description

1. **action**

   Backend script ready to process your passed data.

2. **method**

   Method to be used to upload data. The most frequently used are GET and POST methods.

3. **target**

   Specify the target window or frame where the result of the script will be displayed. It takes values like _blank, _self, _parent etc.

4. **enctype**

   You can use the enctype attribute to specify how the browser encodes the data before it sends it to the server. Possible values are –

   application/x-www-form-urlencoded – This is the standard method most forms use in simple scenarios.

   mutlipart/form-data – This is used when you want to upload binary data in the form of files like image, word file etc.

Note – You can refer to Perl & CGI for a detail on how form data upload works.

HTML Form Controls

There are different types of form controls that you can use to collect data using HTML form –

- Text Input Controls
- Checkboxes Controls
- Radio Box Controls
- Select Box Controls
- File Select boxes
- Hidden Controls
- Clickable Buttons
- Submit and Reset Button

Text Input Controls

There are three types of text input used on forms –

- Single-line text input controls – This control is used for items that require only one line of user input, such as search boxes or names. They are created using HTML <input> tag.
- Password input controls – This is also a single-line text input but it masks the character as soon as a user enters it. They are also created using HTMl <input> tag.
- Multi-line text input controls – This is used when the user is required to give details that may be longer than a single sentence. Multi-line input controls are created using HTML <textarea> tag.

Single-line text input controls

This control is used for items that require only one line of user input, such as search boxes or names. They are created using HTML <input> tag.

Example

Here is a basic example of a single-line text input used to take first name and last name –

```
<!DOCTYPE html>

<html>

  <head>
        <title>Input Control</title>
  </head>

      <body>
          <form>

                    First name: <input type = "text" name = "first name"/>
                    <br>
                    Last name: <input type = "text" name = "last name"/>

                    </form>
        </body>

</html>
```

The above code will produce the following output

```
┌──────────────────────────────────────────┐
│                                          │
│   First Name:[                        ]  │
│                                          │
│   Last Name: [                        ]  │
│                                          │
└──────────────────────────────────────────┘
```

Attributes

Following is the list of attributes for <input> tag for creating text field.

Sr.No	Attribute & Description
1	**type** Indicates the type of input control and for text input control it will be set to text.
2	**name** Used to give a name to the control which is sent to the server to be recognized and get the value.
3	**value** This can be used to provide an initial value inside the control.
4	**size** Allows one to specify the width of the text-input control in terms of characters.
5	**maxlength** Allows one to specify the maximum number of characters a user can enter into the text box.

Password input controls

This is also a single-line text input but it masks the character as soon as a user enters it. They are also created using HTML <input>tag but type attribute is set to password.

Example
Here is a basic example of a single-line password input used to take user password –
```html
<!DOCTYPE html>
<html>

  <head>
    <title>Password Input Control</title>
  </head>

  <body>
```

```
<form >
   User ID : <input type = "text" name = "user_id" />
   <br>
   Password: <input type = "password" name = "password" />
   </form>
 </body>

</html>
```

This will produce the following result –

```
User ID:
Password:
```

Attributes

Following is the list of attributes for <input> tag for creating password field.

Sr.No	Attribute & Description
1	**type** Indicates the type of input control and the password input control it will be set to password.
2	**name** Used to give a name to the control which is sent to the server to be recognized and get the value.
3	**value** This can be used to provide an initial value inside the control.
4	**size** Allows one to specify the width of the text-input control in terms of characters.
5	**maxlength** Allows one to specify the maximum number of characters a user can enter into the text box.

Multiple-Line Text Input Controls

This is used when the user is required to give details that may be longer than a single sentence. Multi-line input controls are created using HTML <textarea> tag.

Example

Here is a basic example of a multi-line text input used to take item description –

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```
<!DOCTYPE html>
<html>

  <head>
    <title>Multiple-Line Input Control</title>
  </head>

  <body>
    <form>
      Description : <br />
      <textarea rows = "5" cols = "50" name = "description">
        Enter description here...
      </textarea>
    </form>
  </body>

</html>
```

This will produce the following result –

Attributes
Following is the list of attributes for <textarea> tag.

Sr.No	Attribute & Description
1	**name** Used to give a name to the control which is sent to the server to be recognized and get the value.
2	**rows** Indicates the number of rows of a text area box.
3	**cols** Indicates the number of columns of a text area box

Checkbox Control
Checkboxes are used when more than one option is required to be selected. They are also created using HTML <input> tag but type attribute is set to checkbox..

Example

Here is an example HTML code for a form with two checkboxes –

```
<!DOCTYPE html>
<html>

  <head>
    <title>Checkbox Control</title>
  </head>

  <body>
    <form>
      <input type = "checkbox" name = "maths" value = "on"> Computer Science
      <input type = "checkbox" name = "physics" value = "on">Maths
    </form>
  </body>

</html>
```

This will produce the following result –

Attributes

Following is the list of attributes for <checkbox> tag.

Sr.No	Attribute & Description
1	**type** Indicates the type of input control and for checkbox input control it will be set to checkbox..
2	**name** Used to give a name to the control which is sent to the server to be recognized and get the value.
3	**value** The value that will be used if the checkbox is selected.
4	**checked** Set to checked if you want to select it by default.

Radio Button Control

Radio buttons are used when out of many options, just one option is required to be selected. They are also created using HTML <input> tag but type attribute is set to radio.

Example
Here is example HTML code for a form with two radio buttons –

```
<!DOCTYPE html>
<html>

  <head>
    <title>Radio Box Control</title>
  </head>

  <body>
    <form>
      <input type = "radio" name = "subject" value = "maths"> Computer Science
      <input type = "radio" name = "subject" value = "physics"> Maths
    </form>
  </body>

</html>
```

This will produce the following result –

Attributes
Following is the list of attributes for radio button.

Sr.No	Attribute & Description
1	**type** Indicates the type of input control and for checkbox input control it will be set to radio.
2	**name** Used to give a name to the control which is sent to the server to be recognized and get the value.

3	value
	The value that will be used if the radio box is selected.
4	checked
	Set to checked if you want to select it by default.

Select Box Control
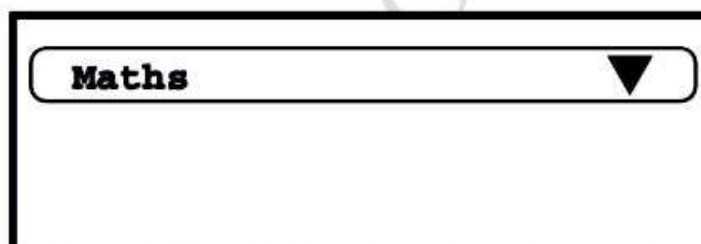
A select box, also called drop down box provides an option to list down various options in the form of drop down list, from where a user can select one or more options.

Example

Here is example HTML code for a form with one drop down box

```html
<!DOCTYPE html>
<html>

   <head>
      <title>Select Box Control</title>
   </head>

   <body>
      <form>
         <select name = "dropdown">
            <option value = "Computer Science" selected>Maths</option>
            <option value = "Maths">Physics</option>
         </select>
      </form>
   </body>

</html>
```

This will produce the following result –

Attributes

Following is the list of important attributes of <select> tag –

Sr.No	Attribute & Description

1	name
	Used to give a name to the control which is sent to the server to be recognized and get the value.
2	size
	This can be used to present a scrolling list box.
3	multiple
	If set to "multiple" then allows a user to select multiple items from the menu.

Following is the list of important attributes of <option> tag –

Sr.No	Attribute & Description
1	**value**
	The value that will be used if an option in the select box is selected.
2	**selected**
	Specifies that this option should be the initially selected value when the page loads.
3	**label**
	An alternative way of labeling options

File Upload Box

If you want to allow a user to upload a file to your web site, you will need to use a file upload box, also known as a file select box. This is also created using the <input> element but type attribute is set to file.

Example

Here is an example of an HTML code for a form with one file upload box –

```
<!DOCTYPE html>
<html>

  <head>
    <title>File Upload Box</title>
  </head>

  <body>
    <form>
      <input type = "file" name = "fileupload" accept = "image/*" />
    </form>
  </body>

</html>
```

This will produce the following result –

```
( Chosen File )  No file chosen
```
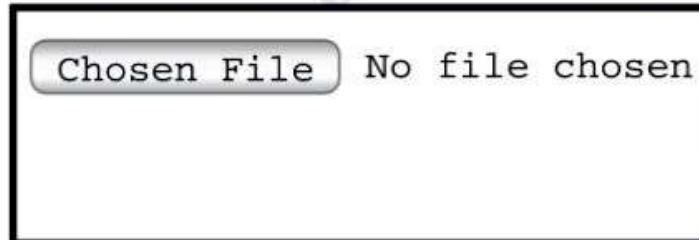
Attributes

Following is the list of important attributes of file upload box –

Sr.No	Attribute & Description
1	**name** Used to give a name to the control which is sent to the server to be recognized and get the value.
2	**accept** Specifies the types of files that the server accepts.

Button Controls

There are various ways in HTML to create clickable buttons. You can also create a clickable button using <input>tag by setting its type attribute to button. The type attribute can take the following values –

Sr.No	Type & Description
1	submit This creates a button that automatically submits a form.
2	reset This creates a button that automatically resets form controls to their initial values.
3	button This creates a button that is used to trigger a client-side script when the user clicks that button.
4	image This creates a clickable button but we can use an image as background of the button.

Example

Here is example HTML code for a form with three types of buttons –

```
<!DOCTYPE html>
<html>
```

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```html
<head>
  <title>File Upload Box</title>
</head>

<body>
  <form>
    <input type = "submit" name = "submit" value = "Submit" />
    <input type = "reset" name = "reset"  value = "Reset" />
    <input type = "button" name = "ok" value = "OK" />
    <input type = "image" name = "imagebutton" src = "/html/images/logo.png" />
  </form>
</body>

</html>
```
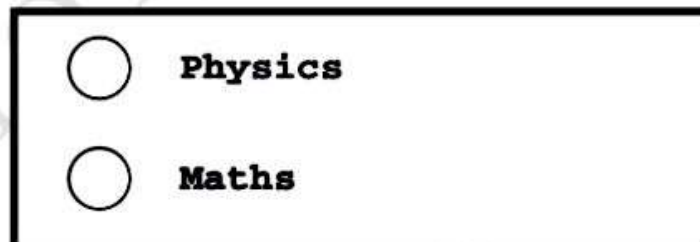
This will produce the following result –

Pluggins and extensions in web development

HTML Helpers (Plug-ins)
Helper applications (plug-ins) are computer programs that extend the standard functionality of a web browser.

Examples of well-known plug-ins are Java applets.
Plug-ins can be added to web pages with the <object> tag or the <embed> tag.
Plug-ins can be used for many purposes: display maps, scan for viruses, verify your bank id, etc.
The <object> Element
The <object> element is supported by all browsers.
The <object> element defines an embedded object within an HTML document.
It is used to embed plug-ins (like Java applets, PDF readers, Flash Players) in web pages.

Example
<object width="400" height="50" data="bookmark.swf"></object>
The <object> element can also be used to include HTML in HTML:

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Example

```
<object width="100%" height="500px" data="snippet.html"></object>
```

Or images if you like:

Example

```
<object data="audi.jpeg"></object>
```

The <embed> Element

The <embed> element is supported in all major browsers.

The <embed> element also defines an embedded object within an HTML document. Web browsers have supported the <embed> element for a long time. However, it has not been a part of the HTML specification before HTML5.

Example

```
<embed width="400" height="50" src="bookmark.swf">
```

The <embed> element can also be used to include HTML in HTML:

Example

```
<embed width="100%" height="500px" src="snippet.html">
```

Or images if you like:

Example

```
<embed src="audi.jpeg">
```

Graphic design

Images, patterns, layouts, and other graphic devices composed into a coherent, distinctive design intended for printing or display over visual media. A graphic design does not have to be complicated (containing multitude of graphic elements) to be effective.

Let's look at some examples of web graphics

Logo		Logos are one of the most common uses of web graphics. Most websites have a logo on every page. Logos are usually created using illustration software, such as Adobe Illustrator, then exported to PNG or GIF format.

Photo		Photos are becoming increasingly popular too, especially with so many digital cameras and camera phones available these days. Photos are usually either scanned into the computer, or imported directly from a digital camera. Once the photo is saved on the computer, you can make adjustments, re-size it, and then save it in PNG or JPEG format.
Icons		Icons can help a website look more professional, as well as help users quickly identify the purpose of a link. Icons are usually created using illustration software, such as Adobe Illustrator, then exported to PNG or GIF format.
Decorative Image		Decorative images are often used to do the bits that HTML and CSS can't do. Decorative images are also commonly used for repeating backgrounds on web pages. Depending on the image, a decorative graphic can be created using illustration software such as Adobe Illustrator, or image editing software such as Photoshop or GIMP. It is then exported to PNG or GIF format.

End of chapter questions

1. List any three content management systems (CMS) which can be used to develop websites.
[3 marks]

2. What is meant by the following terms as they are used in web content development:
   a. Plugin
   b. Template
   c. Extensions
[6 marks]

3. Expand the abbreviation HTML
[1 mark]

4. Name any three tags which exist in HTML
[3 marks]

5. You need to be a programmer to use the Content Management Systems to develop websites.
   A. True
   B. False
[1 mark]

6. HTML is a language which needs some programming skills to use it.
   A. True
   B. False
[1 mark]

7. An attribute and a tag in HTML means the same.
   A. True
   B. False
[1 mark]

Chapter 11
Technopreneurship

In this chapter you will learn about:
- The technopreneurship components
- Academic institutions – research and development centres
- Incubation centres
- Science parks

Technopreneurship

Technopreneurship is the merging of knowledge in technology with entrepreneurship skills. It requires not only technical knowledge but also a thorough understanding of creativity, the innovation process, marketing, finance, and strategic thinking. Technopreneurship is not a product but a process of educating and equiping with skills the future of a person, an organization, a nation and the world.

The technopreneurship components

In book one, you learnt what technopreneurship was and focused on one component that is Human resources only. You did not learn the environmental components such as academic institutions, research and development centres. This is what we will be focusing on in this book.

The diagram below shows the technopreneurship components

1. **Human Resources**
   - Research – thinker, idea generator, innovator
   - Development – technical people implementer
   - Marketing people – involving marketing
   - Financer

2. **Environment**
   - Academic institutions – research and development centres
   - Incubation centres
   - Science parks

3. **Laws and Policies**
   - Intellectual Property Rights
   - Technology Licensing Office
   - Legal Services

4. **Financial**
   - Investors
   - Business Sectors

Environment

Previously you learnt what technopreneurship was and focused on one component that is Human resources. Now we are going to take a closer look at the environmental component. Environmental components are the support services and or facilities that are needed for the technopreneur to be successful such as:
- Academic institutions (Universities' and college)
- Incubation Centres
- Science parks (research and development centres).

Academic institutions

The role of academic institutions is to provide students with an adequate level of knowledge and skills that will enable them to undertake professional activities, thus allowing them to start working immediately upon graduation.

Technopreneurial knowledge acquired by students at higher education institutions should not be limited to theory; rather, it should be practice-oriented and applicable for innovation and devising new business processes. The basic goals of technopreneurial education include acquiring knowledge on technopreneurship, developing competences for creation of opportunities, introducing change in complex circumstances, and encouraging entrepreneurial behaviour. The expected outcome of a Technopreneurial program is an increased level of entrepreneurial competences, which in turn ought to increase the entrepreneurial prospects for young people

Local technology academic institutions

1. **Harare Institute of Technology (HIT)**
   Harare Institute of Technology (HIT) is one of Zimbabwe's universities of technology inculcating among its graduates the philosophy of technopreneurship and develop values responsible for a mind-set shift from the traditional

expectation of employment by government, commerce and industry. Under the technopreneurship ethos, graduates will be capacitated to start high –tech enterprises, make an impact on the national economy and have their presence felt on the global market. HIT, under its thrust to incubate, commercialize and transfer technology will contribute to the growth of the national economy by generating jobs and creating wealth. HIT established linkages and strategic partnerships with individuals, corporate and financial institutions to implement and realize this goal. The University creates mechanisms to support internal flexibility and collaboration in mobilizing its capabilities to address key societal issues and problems. Under this goal, HIT will develop various enterprises under its holding company, Institech Holdings.

2. **National University of Science and Technology (NUST)**
   The university offer faculties in Science and Technology Education, Applied Sciences, Built Environment, Industrial Technology among other faculties.

Incubation centre

The term takes off from biological "incubators" where a chicken lays its eggs, and lay on then until they hatch and nurture the young ones. When small businesses (technopreneurs and entrepreneurs) start, they need a bigger and experienced company or organization to nurture them just like how a chicken does to its eggs until they hatch. These companies or organisations are called incubation centres or business incubators. An incubation centre is usually a non-profit organization or a program managed by corporations, educational institutions or government agencies that provide an environment for small companies to develop by providing services such as management training and office space. The term "incubator" is used because the big companies provide an environment designed to help new businesses succeed. Incubation centres are needed to help and nurture the new ideas and talents until new companies are developed.

These are some of the services provided by business incubators
- Help with business basics
- Networking activities
- Marketing assistance
- Market Research
- Help with accounting/financial management
- Access to bank loans, loan funds and guarantee programs
- Links to higher education resources
- Access venture capital
- Comprehensive business training programs
- Management team identification
- Help with the law
- Intellectual property management

The purpose of traditional business incubation schemes has been to increase the chances of survival of new companies and reducing unemployment. The objectives of technology incubators are:

- To help the university graduate to get into the world of production.
- Creating an environment in which technology entrepreneurs can start a business and be able to sale their products on the market.
- Providing assistance to university students to market their research, especially when higher education institutions are directly involved in the promotion and management of the incubator.

The incubation process

Business incubators do not serve any and all companies. Technopreneurs who wish to enter a business incubation program must apply for admission. Acceptance criteria vary from program to program, but in general only those with a small business running and a workable business plan are admitted.

The goal of incubators is to increase the chance that a start-up will succeed, and shorten the time and reduce the cost of establishing and growing its business. If successful, business incubators can help to nurture the companies that will form the true creators of a region's or nation's future wealth and employment.

Incubation centres in Zimbabwe

Business incubators have not been too popular in Zimbabwe, there has been progress in the past few years and there are more incubation centres being opened around the country.

These are:

1. **Muzinda hub**- is one of the first entrepreneurship, innovation and digital skills development supporting business ideas with potential
2. **Emerging Ideas**- it creates start up ecosystems that build outstanding

entrepreneurs and develop their ideas into impactful companies.

3. **Neoclub Technology**- Neoclub is a start-up factory dedicated to building enduring companies in Africa. Their aim is to push at least 20 starts up to market annually.
4. **Hypercube hub**-The hub's mission is to support and integrate the technology entrepreneurship ecosystem while emphasizing social development causes like inclusion of women in technology.

Zimbabwe might not be at the top in technopreneuship but it has put its investments in the Harare Institute Of Technology (H.I.T) and National University of Science and Technology (N.U.S.T). These institutions in Zimbabwe are expected to produce top notch students that are able to par the nation with the rest of the technological giants

Case Study

In November 2014, the Harare Institute of Technology (H.I.T), Sandown Corporate Limited and U.N.D.P Zimbabwe jointly launched their first Business Incubation Programme. This programme was housed at the Harare Institute of Technology and through a 3 month incubation process sought to support young Zimbabweans to transform their technical prototypes into commercially and socially viable ventures. As a result, a total of 10 prototypes were refined and investor ready business plans developed for capital sourcing purposes.

H.I.T Incubation Process

1. **Identify**-H.I.T- identifies 10 high performing graduates with technologically oriented Prototypes
2. **Assess**-H.I.T guides technical & business viability assessments & patenting process
3. **Refine**-Sandown provides-mentorship & coaching through trainings on business skills
4. **Engage**-Sandown engages-in sourcing for local & international joint venture partners & markets
5. **Launch**- Business Incubation Pilot Project officially closes with ceremony celebrating the technopreneurs

Technology Incubation Centre-NUST

The Technology Incubation Centre (TIC) is an initiative of the National University of Sciences and Technology (NUST) to provide a nurturing environment to technology

International Science and Technology Parks

Silicon Valley (USA) was a pioneer in the development of science parks in the world. Originally known as Stanford University Science Park, Silicon Valley dates back to the early 1950s. It was followed by Sophia Antipolis (France) in Europe in the 1960s and Tsukuba Science City (Japan) in Asia in the early 1970s. This trio represents the oldest and the most well-known science parks in the world.

Today, there are over 400 science parks worldwide and their number is still growing. At the top of the list comes the USA, which is reported to have more than 150 science parks. Japan comes next with 111 science parks. China began developing science parks in the mid-1980s and now has around 100, 52 which were approved by the national government and the remainder by local governments.

Activity/Education Tour
Visit /attend an ICT exhibition expo. Write a report on any three technopreneurship components you have encountered.

End of chapter questions

1. Name the four technopreneurship components. (4)
2. Give 2 science parks in Zimbabwe. (2)
3. Incubation centres are needed to _____ and _____ the new ideas and talents until new companies are developed. (2)

End Of Year Examinations

1. Which type of software provides the public with its source code free of charge.
   A. Open-source software
   B. Multitasking systems
   C. UNIX
   D. Systems software

2. What is the smallest unit of computer information
   A. Byte
   B. Bit
   C. Pixel
   D. Binary dot

3. What type of software is an anti-virus software
   A. System Software
   B. Application Software
   C. Utility Software
   D. Malware

4. An Operating System is a :
   A. System Software
   B. Application Software
   C. Utility Software
   D. Malware

5. A graphic artist would use:
   A. Accounting Software
   B. Word Processing Application
   C. Graphics Presentation Software
   D. Antivirus Software

6. A Database is used to:
   A. Store and Organize data in records
   B. Store and Organize papers
   C. Store and Organize records in files
   D. Store and Organize records in fields

7. Word Processing and Desktop Publishing are Applications
   A. True
   B. False

8. Which one of the following applications is used to manage non-numeric lists?
   A. Database Management System

B. Spreadsheet

C. Graphics Software

D. Microsoft Disk Operating System

9. Networks are always connected in the same building

    A. True

    B. False

10. A Network is:

    A. Series of communication points connected by nodes

    B. A Series of points or nodes interconnected by communication paths

    C. Series of nodes connecting paths and interconnections

    D. A path on a Series of interconnecting points

11. When it comes to databases,Records are:

    A. Devices that store music

    B. A combination of related fields

    C. A storage system

    D. None of the above

12. The primary key is a software used to open virtual doors

    A. True

    B. False

13. Microsoft invented DOS.

    A. True

    B. False

14. A web page is

    A. Made up of text and HTML tags

    B. Marked by an opening HTML tag <HTML>

    C. Marked by a closing HTML tag </HTML>

    D. All of these

15. Hackers

    A. all have the same motive

    B. break into other people's computers

    C. may legally break into computers as long as they do not do any damage

    D. are people who are allergic to computers

16. First page of Website is termed as-

    A. Homepage

    B. Index

    C. JAVA script

D. Bookmark

17. Office LANS, which are scattered geographically on large scale, can be connected by the use of corporate
    A. CAN
    B. LAN
    C. DAN
    D. WAN

18. Which programming languages are classified as low level languages?
    A. BASIC, COBOL, Fortran
    B. Prolog
    C. C, C++
    D. Assembly languages

19. ASCII stands for
    A. American Stable Code for International Interchange
    B. American Standard Case for Institutional Interchange
    C. American Standard Code for Information Interchange
    D. American Standard Code for Interchange Information

20. Select the Odd one
    A. Operating system
    B. Interpreter
    C. Compiler
    D. Assembler

21. Why is it unethical to share copyrighted files with your friends?
    A. It is not unethical, because it is legal.
    B. It is unethical because the files are being given for free.
    C. Sharing copyrighted files without permission breaks copyright laws.
    D. It is not unethical because the files are being given for free.

22. A person who used his or her expertise to gain access to other people's computers to get information illegally or do damage is a-
    A. Hacker
    B. spammer
    C. instant messenger
    D. programmer

23. The process of transferring files from a computer on the Internet to your computer is called
    A. Downloading
    B. uploading
    C. FTP

D. JPEG

24. ASCII is a coding system that provides
    A. 256 different characters
    B. 512 different characters
    C. 1024 different characters
    D. 128 different characters

25. Which of the following is not a binary number?
    A. 001
    B. 101
    C. 202
    D. 110

26. The typical computer criminal is a(n):
    A. Young hacker.
    B. Trusted employee with no criminal record.
    C. Trusted employee with a long, but unknown criminal record.
    D. Overseas young cracker.

27. The common name for the crime of stealing passwords is:
    A. Jacking.
    B. Identity theft.
    C. Spoofing.
    D. Hacking

28. Collecting personal information and effectively posing as another individual is known as the crime of:
    A. Spooling.
    B. Identity theft.
    C. Spoofing.
    D. Hacking.

29. Malicious software is known as:
    A. Badware.
    B. Malware.
    C. Maliciousware.
    D. Illegalware.

30. A program that performs a useful task while simultaneously allowing destructive acts is a:
    A. Worm.
    B. Trojan horse.
    C. Virus.
    D. Macro virus.

31. An intentionally disruptive program that spreads from program to program or from disk to disk is known as a:
    A. Trojan horse.
    B. Virus.
    C. Time bomb.
    D. Time-related bomb sequence.

32. What is the most common tool used to restrict access to a computer system?
    A. User logins
    B. Passwords
    C. Computer keys
    D. Access-control software

33. Hardware or software designed to guard against unauthorized access to a computer network is known as a(n):
    A. Hacker-proof program.
    B. Firewall.
    C. Hacker-resistant server.
    D. Encryption safe wall.

34. The scrambling of code is known as:
    A. Encryption.
    B. a firewall.
    C. Scrambling.
    D. Password proofing.

35. "MAN" stands for
    A. Maximum Area Network
    B. Minimum Area Network
    C. Main Area Network
    D. Metropolitan Area Network

36. Which of the following is a network topology
    A. LAN
    B. WAN
    C. MAN
    D. BUS

37. Which of the following is a type of network
    A. Ring
    B. Bus
    C. Star
    D. PAN

38. The use of video conferencing technology in a fourth-grade class would be most appropriate for which of the following purposes?
    A. viewing virtual field trips to museums, cultural centers, or national monuments
    B. watching a prerecorded digital presentation that enhances an instructional unit
    C. communicating with students in another country so students can learn about each other's cultures
    D. recording and editing a digital movie of a class play that will be posted on the school's Web page

39. Advantages of Relational Database Management systems are
    A. Flexibility, of relating different logical files
    B. Security controls can be more easily implemented
    C. Data independence since it allows the database to grow by adding new attributes and relations
    D. All of the above

40. Data manipulation language (DML)
    A. describes how data are structured in the data base
    B. determine how data must be structured to produce the user's view
    C. specifies for the DBMS what is required; the techniques used to process data
    D. All of the above

41. A feasibility study is carried out
    A. after final requirements specifications are drawn up
    B. during the period when requirements specifications are drawn up
    C. before the final requirements specifications are drawn up
    D. at any time

42. The main objective of a feasibility study is
    A. to assess whether it is possible to meet the requirements specifications
    B. to assess if it is possible to meet the requirements specified subject to constraints of budget, human resource and hardware
    C. to assist the management in implementing the desired system
    D. to remove bottlenecks in implementing the desired system

Structured questions

1. Define the following terms as they are used in Computer Science giving examples where appropriate:
    a. Application software
    b. Shareware
    c. Freeware
    d. Open source software   [8 marks]

2. Name TWO services an ISP can provide other than Internet access. [2 marks]
3. .Explain HTTP of internet terminologies. (2)
4. Explain URL of internet terminologies. (2)
5. What is the difference between Web site and Web Application? (2)
   Explain the consideration when designing a website. (2)
   Explain Cross Site Scripting. (2)
   Explain <p> tag. (2)
   Explain tag, <ul> tag and <li> tag. (2)
   Explain IP filtering. (2)

6. A database, STAFFPHONE, was set up to show the telephone extension numbers for members of staff working in a department store.

Name	Department	Extension number
Jane	Smith Toys	129
Simba	Books	124
Tonderai	Toys	129
Chiedza	Household	123
Farisai	Books	124
Rutendo	Shoes	125
Takatenda	Shoes	125
Takunda	Toys	129

(a) Explain why none of the fields in the database can be used as a primary key. ....
....
....
....[2]

(b) State a field that could be added as a primary key. ....
....

(c) Give a reason for choosing this field. ....
....
....[2]

(d) Use the query-by-example grid below to provide a list of all members of staff, in alphabetical order, grouped by department.

Field:			
Table:			
Sort:			
Show:			
Criteria:			
Or:			

8. Data is valuable. It needs to be kept secure and it can easily be damaged. Give three different ways that data can be accidentally damaged. 1 ....
....
.... 2 ....
....
.... 3 ....
....
.... [3]

9. A large comprehensive school has over 500 computers connected to their Local Area Network (LAN) with a connection to the Internet. (a) Describe, in detail, four disadvantages for the school of having a network of computers compared to stand alone computers. [8] Disadvantage 1 ....
.... Disadvantage 2 ....
.... Disadvantage 3 ....
.... Disadvantage 4 ....
.... (b) All staff and pupils have a unique username and a password to access the network. State three rules that should apply to users' passwords to reduce the possibility of someone guessing a password. [3]Rule1..
.... Rule 2..
.... Rule3..
....

10. Write an algorithm using pseudo code that will accept a number for day and convert it to the day name. Use the following;
   1 - Sunday
   2 - Monday
   3 - Tuesday
   4 - Wednesday
   5 - Thursday
   6 - Friday
   7 - Saturday

11. The program must display the corresponding day once the user key in the number. E.g. If the user enters 2 the program must display Tuesday.   [10 Marks]

12. Given that the US Dollar Exchange rate against other currencies is as follows:
   1USD is equivalent to 12 South African Rands
   1USD is equivalent to 5 Zimbabwean Dollars
   1USD is equivalent to 10 Chinese Yuan
   1USD is equivalent to 2 British Pounds

13. Code a program in pseudocode that accept a given amount in US Dollars and convert it to

the requested currency. [10 marks]

Write an algorithm using pseudocode that will produce the Flyod's Triangle:

1
2 3
4 5 6
7 8 9 10   [10 marks]

14. Outline the forms of the following control structures in Visual Basic.Net through examples
Repetition
    i. For…To…Next   [5marks]
    ii. For…To…Step…Next   [5 marks]
    iii. Do…Loop Until…   [5 marks]
    iv. While…End While   [5 marks]

15. Outline any four positive effects brought by the use of computers in the Health sector.
[4 marks]

16. Give THREE reasons why a company would install and use a webcam AND a GPS in a bus or taxi to record the journey. [3 mark]

GLOSSARY

Application Suite -	Application suite, also known as application stack or application set, is a group of applications closely related in functionality.
Application	The use to which a data processing system is put within a given discipline, such as a payroll application, an airline reservation application or a network application.
Application program	A program that is written for or by a user that applies to the user's discipline.
Application software	A group of programs designed to perform tasks that can be tailored to a user's specific needs.
Assembly	Assembly refers to all of the files that comprise an application, including the resource, security management, versioning, sharing and deployment information.
Assembly Language	Assembly language is a type of computer CPU programming language, which consists entirely of numbers and are almost impossible for humans to read and write.
Bespoke Software	Bespoke software refers to the custom-made software products, including made-to-order software.
Binary	A file containing one or more strings of data bits which are not printable
Binary number	A number written using binary notation which only uses zeros and ones. Example: decimal number seven in binary notation
Copyright	Copyright is a set of exclusive rights regulating the use of a particular expression of an idea or information, including but not limited to art designs, computer software, books, documents etc.
Client	A computer program that uses the services of another computer program. Software that extracts information from a server; your auto-dial phone is a client, and the phone company is its server.
Client/server	A relationship in which client software obtains services from a server on behalf of a person.
Cyberspace	The nebulous "place" where humans interact over computer networks (the Internet is considered Cyberspace). Coined by William Gibson in Neuromancer.
Database Model	A database model is a theory or algorithm describing how a database is structured and used.
Data entry	The entry of data into a computer or onto a computer-readable medium by an operator from a single data device, such as a card reader or keyboard.
DBMS	Data Base Management System.

Debug	To detect, trace and eliminate errors in computer programs
Execute	To interpret a computer instruction and carry out the operations specified in the instruction.
E-mail server	A computer system that provides MTA, mailbox storage and directory services and optionally UA services.
Freeware	Software provided at no cost to the user
Java -	Java, in computer programming, is an object-oriented programming language developed by Sun Microsystems. It resembles C++, but was designed to avoid some of C++'s most notorious flaws.
MySQL	MySQL is a multithreaded, multi-user, SQL (Structured Query Language) Database Management System (DBMS).
Shareware	Shareware is a type of software distributed on the basis of an honor system.
Shelfware	Shelfware refers to the software that gets purchased by a company or individual that ends up sitting on a shelf somewhere and not being used.
Utility Program	Utility program, or utility, is a type of computer program that support using the computer, an application or a development environment.
User Interface	The user interface is the aggregate of means by which people (the users) interact with a particular machine, device, computer program or other complex tool (the system).
Variable	In social science research, for each unit of analysis, each item of data (e.g., age of person, income of family, consumer price index) is called a variable.
Vision	A future oriented statement of where you want to be, and how you want things to be
Workstation	A general purpose computer that is small enough and inexpensive enough to reside at a person's work area for his or her exclusive use.