9.2 Information Systems and Databases

Information systems are computer systems that support end users, giving them access to the information. For a large number of information systems, the data is held in databases and access is via database management systems. Information systems perform a variety of tasks and these are considered in the following topics in the HSC course. While all of the information processes are represented in information systems, the emphasis in this topic is on the processes of organising, storing and retrieving with database systems and hypermedia.

Outcomes

A student:

H1.1 applies and explains an understanding of the nature and function of information technologies to a specific practical situation
H1.2 explains and justifies the way in which information systems relate to information processes in a specific context
H2.1 analyses and describes a system in terms of the information processes involved
H2.2 develops and explains solutions for an identified need which address all of the information processes
H3.1 evaluates and discusses the effect of information systems on the individual, society and the environment
H3.2 demonstrates and explains ethical practice in the use of information systems, technologies and processes
H4.1 proposes and justifies ways in which information systems will meet emerging needs
H5.1 justifies the selection and use of appropriate resources and tools to effectively develop and manage projects
H5.2 assesses the ethical implications of selecting and using specific resources and tools, recommends and justifies the choices
H6.1 analyses situations, identifies needs, proposes and then develops solutions
H6.2 selects, justifies and applies methodical approaches to planning, designing or implementing solutions
H7.1 implements and explains effective management techniques
H7.2 uses methods to thoroughly document the development of individual and team projects.

1. Information System	
Students learn to:	*Notes:*
▪ The characteristic of an information system, namely: – the organisation of data into information – the analysing of information to give knowledge	▪ The **aim** for all information system is **to produce information from data to system's end users**. These end users will analyse this information and gain knowledge. The system's purpose can only be achieve if the **knowledge is gained**. – The organisation of data into information ▪ Data must be organised before it can be stored and analysed by the information system. If data is not organised then, the resulting information is useless. Organisation requiring sorting, summarising or classifying. Data can be organised via a data dictionary. ▪ Data is organised ➔ Then Stored ➔ And Analysed – The analysing of information to give knowledge ▪ As mention above, knowledge from information is the purpose of information system. ▪ Information ➔ when analysed ➔ gives out knowledge ▪ Analysing data can be searching, sorting, graphing, predicting arranging, selecting, modelling, simulation. ▪ There are a variety of tools to analyse information system, such as table, queries and reports. ▪ Individual are to make decisions based on their attained knowledge given by the information in the information system.
▪ The different types of and purposes of an information system, including system used to: – Process transactions – Provide user with information about the organiser – Help decision making – Manage information used within an organisation	▪ There are different types of information system with unique purposes. But they are changing and updated due to the advancement of technology. ▪ **Types** of Information System: – **Transaction Processing System [TPS]** ▪ Collect, store, modify and retrieve the daily transactions of an organisation made from consumers. ▪ Examples of requiring TPS: – Consumers buying goods from Point of Sales [POS] terminal. – Processing credit card payments – Receipts and other evidence of purchase made by the supplier. – All these are transaction made when consumers purchase goods/services. ▪ If the TPS were to breakdown, then it will cause discrepancy within the organisation and business are required to even stop. Since organisation rely heavily on TPS. TPS are often equip with good design backup and recovery procedures to prevent further problems. ▪ There are two types of TPS: – Batch Processing: Collects data in a group and processes it later. – Real-time Processing: Each transaction is processed immediately. – **Decision Support System [DSS]** ▪ DSS are design to assist/support people with making decisions. [We humans are still in control of the decisions, DSS are there

merely to 'support us' and provide guidance].

- They can be used in organisation when they must make sudden and expecting decisions and changes.
- Reason and Examples if DSS:
  - Computation
    - Bureau of Meteorology [Government Organisation] ➔ Weather predictions
    - Since it's difficult for humans to commute weather predictions, they rely on computerised technology to make decisions on future weather possibilities.
    - Data like, temperature, humidity, air pressure, are all collected and analyse to make future decision on the upcoming weather.
  - Lots of data
    - Apple [Business Organisation] ➔ Apple Watch [Global release]
    - With such massive organisation, Apple can't afford to make the slightest mistakes.
    - They need to have a lot of data like, where they with sell, when they will release, how many Apple Watches are need to be made for everyone. Apples must require a lot of data gathered from all theirs stores to make efficient and accurate decision so that they don't mislead customers.
  - High consistency
  - Time management
- They are made via tools like statistic tools, databases, spreadsheet and graphs. These models allow organisations to ask what-if- scenarios.

- **Expert System**
  - Expert Systems are a type of DSS.
  - Expert Systems provide information and solve problems that would otherwise require a person experienced in the field.
  - 4 types of components:
    - Knowledge Base
      - Follows the If-then rules. Example is a doctor diagnosing the symptoms and using his experience with that symptoms prescribe antibiotics.
    - Database of Fact
      - Are used in current situations. Example doctors diagnosing a new type of symptoms. They will ask questions and gather information to best found the most suitable antibiotics.
    - Interference Engine
      - Takes Knowledge Base and Database of Facts and processes in conclusion(s).
    - Explanation Mechanism
      - Takes the questions in Databases of Facts the conclusions and explains why the conclusions is that, with the use of knowledge base and Database of Facts.

	– **Management Information System [MIS]** ▪ Provide information on the performance on the organisation, ▪ Examples of MIS: – Reports on Sales, inventory, payroll, budget, orders. ▪ Having an MIS, MIS can be used to motivate workers and make decisions. – **Office Automated System [OAS]:** ▪ OAS provide people with effective ways to complete administration tasks in an organisation. ▪ Uses tools such as, Word processors, spreadsheets, databases, publishing programs and project management software.

Students learn to:	*Notes:*
▪ Identify the type and purposes of a given information system	
▪ The different types of and purposes of an information system, including system used to: – Identify the purpose, information processes, information technology and participants within a given system – Represent diagrammatically the flow of information within an information system	

2. Database Information System	
Students learn about:	*Notes:*

▪ School database holding information on teacher, classroom, subject and students.	▪
▪ The Roads and Traffic Authority holding information on automobiles and holders of driver's licences	▪
▪ Video stores holding information on borrowers and videos	▪

Students learn to:	*Notes:*
▪ Identify participants, data/information and information technology for the given examples of database information systems	
▪ Describe the relationships between participants, data/information and information technology for the given examples of databases information systems	

3. Organisation

Students learn about:	*Notes:*
▪ Non-computer method of organising including: – Telephone books – Card base application	▪ Organising: The process where data is formatted into its appropriate structure for further use in an information system. [arranging, representing and formatting data]. ▪ A database is an organised collection of data. ▪ Examples of Non-computer method of organising data: – Telephone books – Card base applications – Dictionaries – Paper filing cabinet
▪ Computer base method of organising include: – Flat file system – Database management system – Hypermedia	▪ Examples of Computer base method of organising data: – Flat file system – Database Management System [DBMS] – Hypermedia – Records ▪ Computer based databases is being increasingly used taking over non-computer based methods.
▪ the advantages and disadvantages of computer based and non-computer based organisation methods	▪ **Non-computer Based Database** Advantages: ▪ Convenient to obtain information ▪ Easy and inexpensive to organise data ▪ Does not require a computer or the needs of computer skills ▪ Easier to keep secure and remain for private Disadvantages: ▪ Less environmentally friendly ▪ Difficult to update and sort data out ▪ Time consuming to search for the information ▪ Takes up a lot of physical space ▪ Cane be stolen, or a disaster can destroy all the information system ▪ **Computer Based Database** Advantages: ▪ Easily edited ▪ Larger storage Disadvantages: ▪ Cloud failure ▪ Computer skills are required

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Fast retrieval
Display options
Faster access to information
Can be backup to prevent data lose
Sorting of data is more flexible over a range of fields
Can be accessed by one then one individual

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Virus and malfunctions to the computer can wipe the whole database
Prone to hacker and computer scammers
Requires electricity for access

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The logical organising of flat-file database, including:

Files
Record
Field, Key Fields
Character

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All the data in Flat File Databases are organised in one single table. Thus, there is no relationship between data. [This mean data can be repeated].
They may be simple and easy to use, but they have limitations for accessing data such as, sorting and searching, due to all the data in one single table.
Suitable for small data, as they are less complex then relational, making them easier to manage.
Flat file databases organise data using data structure which includes:

Files: A file is a block of data. Whatever data, you enter, edit, or save is stored as a file. Example ➔ The Flat file database is named the one table file.
Record: This is a collection of facts about one specific entry in a database. Example ➔ A record consist of All the fields about one patient; 134, Jeff, 4-Jul-1993, Male, 7876453, 01, Dr Hyde, 03.
Field: These are specific category names of data in a database. Example ➔ Patient ID, Name, DOB, Gender, Phone, Doctor ID, Doctor, Room. Within these Fields are characters
Characters: These are the smallest unit of data that people can use. They can be numbers, letters, and special symbols. Example ➔ Jeff, Male, Female, 01, Dr Hyde

Flat-File (one table)
<table>
<tr><th>Patient Id</th><th>Name</th><th>D.o.B</th><th>Gender</th><th>Phone</th><th>Doctor Id</th><th>Doctor</th><th>Room</th></tr>
<tr><td>134</td><td>Jeff</td><td>4-Jul-1993</td><td>Male</td><td>7876453</td><td>01</td><td>Dr Hyde</td><td>03</td></tr>
<tr><td>178</td><td>David</td><td>8-Feb-1987</td><td>Male</td><td>8635467</td><td>02</td><td>Dr Jekyll</td><td>06</td></tr>
<tr><td>198</td><td>Lisa</td><td>18-Dec-1979</td><td>Female</td><td>7498735</td><td>01</td><td>Dr Hyde</td><td>03</td></tr>
<tr><td>210</td><td>Frank</td><td>29-Apr-1983</td><td>Male</td><td>7943521</td><td>01</td><td>Dr Hyde</td><td>03</td></tr>
<tr><td>258</td><td>Rachel</td><td>8-Feb-1987</td><td>Female</td><td>8367242</td><td>02</td><td>Dr Jekyll</td><td>06</td></tr>
</table>

Key Fields: These are mainly used relational database to link in between tables. There meaning: Are fields used to sort and retrieve information.

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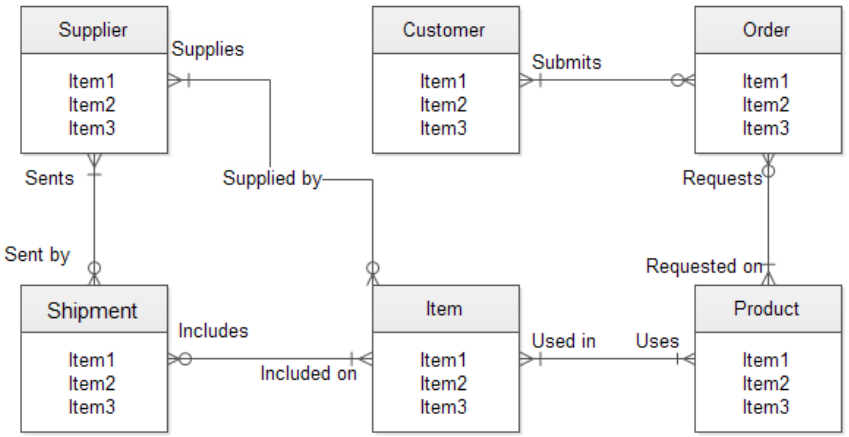
	▪ Primary Key [PK]: A field that is unique or contains value that will differentiate from other tables. One table must only contain one PK. PK can't be empty or null; they must contain value. [Usually denoted as PK or is underlined]. ▪ Foreign Key [FK]: A field of a table that is the primary key of another table. They are usually link for a connection between entities. ▪ Secondary Key: A field that contains useful items of data often used in searches. ▪ Composite Key: Is made by joining 2 or more fields together.
▪ The logical organising of relational database, including: – Schemas - Entities - Attributes - Relationship ▪ One to One ▪ One To Many ▪ Many To Many – Tables as the implementation of entities consisting of: - Attributes - Record – Linking tables using primary and foreign keys – User views for different purposes	▪ Relational Database organises data using a series of related tables. They are linked with 'Keys' and are done with relationship which are built between tables. They provide manipulation and combing/ linking two or more databases together. ▪ They provide more of a security and grant permission of users. ▪ They are low in data redundancy and are used for large complex data. ▪ They are usually done by a Schema or Entity Relationship Database [ERD]. – Schema are a visual representation of an organised plan of the entire database showing how the where the data is found and their relationship, entities and attributes. - Entities: ▪ Can be known as Table name ▪ A specific title about which information is collected and stored ▪ Examples ➔ Suppler, Customer, Order - Attributes: ▪ Can be known as Field name ▪ Defined as property of an entity ▪ Example ➔ Item1, Item2, Item3 - Relationship: ▪ Table in an ERD are linked via relationships. There are three type of relationships – One to One [1:]: When each record in the first entity is related to exactly one record in the second entity. Example: A customer only buy one car, and vice versa, each new car is related or under contact to one customer. – One to Many [1:m]: When one attribute/record in one entity is related to many attribute/record in the second entity, but any attributes in the second entity can only relate to one attribute in the first entity. Example: One student can borrow many books, but any of that one book can only be borrowed by one student. – Many to Many [m:m]: When each record in the first entity is related to many records in the second entity, and each of the record in the second entity is related to many record in the first entity. Example: One student can study many subjects, and each of that one student subjects is studied by many other

	students.  – Tables as implementation of entities consisting of: - Attributes - Records – Linking tables using primary key and foreign key – Users views for different purposes - The main four database views. These views are used to view the same data ▪ **Query View** ▪ **Form View** ▪ **Report View** ▪ **Table View** ▪ Note that Design View is not a form of viewing as it allows the manipulation of data.
▪ Data modelling tools for organising databases, including: – Data dictionaries to describe the characteristics of data including: - Field Name - Data Type	▪ Data modelling: This is the process of identifying and organising databases into Entities, Relationships and Attributes. [Used to develop a Schema]. – Data dictionaries to describe the characteristics of data including: - Field Name - Data Type - Data Format

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- Data Format
- Field Size
- Description
- Example
– Schematic diagrams that show the relationships between entities
– Normalising data to reduce data redundancy
</td>
<td>
- Field Size
- Description
- Example
– Schematic Diagrams that show the relationship
<table>
<tr><th>Field name</th><th>Data type</th><th>Data Format</th><th>Field Size</th><th>Description</th><th>Example</th></tr>
<tr><td>User ID</td><td>Text</td><td>NNNNNNNN</td><td>8</td><td>Unique eight digit number represented as text</td><td>0001539</td></tr>
<tr><td>First Name</td><td>Text</td><td></td><td>25</td><td>First name of employee</td><td>Bill</td></tr>
<tr><td>Surname</td><td>Text</td><td></td><td>25</td><td>Surname of employee</td><td>Smith</td></tr>
<tr><td>DOB</td><td>Date</td><td>DD/MM/YYYY</td><td>10</td><td>Date of birth as a short date format</td><td>15/07/1982</td></tr>
<tr><td>Hourly Pay Rate</td><td>Currency</td><td>#####.##</td><td>8</td><td>Rate of pay expressed in dollars per hour</td><td>34.50</td></tr>
<tr><td>Height</td><td>Real</td><td>#.##</td><td>3</td><td>Height in metres, with two decimal places</td><td>1.58</td></tr>
<tr><td>Fees Paid</td><td>Boolean</td><td></td><td>1</td><td>Y or N for Yes or No</td><td>Y</td></tr>
</table>
– Normalising data to reduce data redundancy
▪ Data redundancy: When data is recurred and that takes a lot of space/storage. [Unnecessary repetition or duplications of data in a database].
Main reason for minimising data redundancy is to provide for space for our database. [Less duplicates ➔ less bits ➔ more space]
▪ Normalisation: is the process of organising data into different tables and create a efficient database schema for the organisation of data within a relational database
▪ What is normalisation and how can we reduce data by normalising?
– Normalisation is used in the design of relation databases, where data duplication is minimised by breaking data into numbers of smaller linked tables. These tables will have fields and relationships and hence are linked. Thought unnecessary redundancy of data many occur. Databases will a 3rd Normal form will increase it data integrity and hence have no data redundancy.
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▪ The logical organisation of hypermedia, including
– Nodes and Links
– Uniform resources locators
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▪ Hypermedia: is a combination of media whose location are linked electronically.
▪ Examples of Hypermedia is YouTube or Google. They are a medium for hypertext to be linked.
▪ They are easier to navigate and allow other individuals access to the information world wide.
▪ The information is stored using set of documents. These documents can be text, image, audio, video, or other programs.
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</table>

– Metadata such as HTML tags	▪ Each of these documents are independent ➔ One can work without the other and the information is retrieved via Hypertext. ▪ Hypertext: is a term used to describe the body of a text that allow documents to be cross linked in way where participants can move from one document to another by clicking on the link [Hyperlink]. ▪ Hyperlink: The organisation of hypertexts, are hyperlinks. They are usually being indicated by a blue underlined/highlighted item/text that allows electronic connections. These hyperlinks or the author of the hyperlink must have a specific location of the information. – Node and Links ▪ Nodes: Nodes are devices and data points on a larger network. – If the information [which is hyperlinked] is stored in another computer at another destination, then that computer is known as a node. [The computer is a point where the link is connected to]. – Nodes are connected to a network. In other words, it is a location or a point in the hypermedia system at which the data is stored. – The user follows a link embedded within a node and is taken to another node. This new node many also contain links that are embedded in this new node, to further nodes. These are all points in the media at which connects to the network. ▪ Links: Commonly known as 'Hyperlink' is a connection between one document [node] to another. ▪ Navigation between nodes take a user many places in complex and unstructured ways. The most well-known and the largest hypermedia/hypertext is the World Wide Web [WWW]. This application of hypermedia can have infinite amount of nodes connections. Each of these documents are accessed via its Uniform Resource Locator [URL]. – Uniform Resource Locator ▪ Uniform Resource Locator [URL]: URL is the address of a file on the Web. ▪ They are usually written in lower cases with no spaces ▪ Example of an URL: https://www.hi.com.au/atlas/about.htm – https ➔ Protocol: the rule that allow the transfer of data on the Web. Other Examples include, ftp, https, ip, tcp. – www ➔ Simply denotes that this file is the Webs [World Wide Web]. – Hi.com ➔ Domain Name: The address in which that the file is located – Au ➔ Usually in two letters denoting the country of the website. – Atlas ➔ Sub Directory Name ➔ another located within the website – About ➔ Filename ➔ Occurs at the ending of the address link indicating the name of the file – Htm ➔ Stands for Hypertext Mark-up Language [HTML] ➔ It's the code used to format the website. ▪ URLs can be saved and stored [Favourites/Bookmark]. – Metadata such as HTML tags ▪ Metadata: They are HTML tags or the information about the data.

	▪ HTML tags starts with < > and ends as </ > Example <H2> HTML </H2> The <H2> </H2> define that HTML is a heading type of data. [So basically HTML tags are data about the data]. ▪ All these organisations of hypermedia are made from HTML since the largest network or source comes from WWW and HTML is the scripting language for WWW. [Formatting language for websites].
▪ Tools for organising hypermedia – Storyboards to represent data organised using hyperlinks – Software's that allows text, graphics and sounds to be hyperlinked	▪ Just like databases; hypermedia needs tools that can organise the data. – Storyboards to represent data organised using hyperlinks ▪ Storyboard is a tool that is used to organised hypermedia. They are set in a series of frames representing the links and how the website is navigated. ▪ Important: Storyboards must contain a navigation link/map to allow users a clearly layout of the screen items that are placed. It is useful for indicating which items belong to which page ▪ They are popular due it's to simplicity to make. ▪ **4 types** of Storyboards: – Linear – Hierarchical – Non-linear – Composite

Students learn to:	*Notes:*
▪ Choose between a computer based or non-computer based method to organise data, given a particular set of circumstances	▪ Organisation of data of both computer based and maual data have its advantages and disadvantages. ▪ Although computer based method od organisation has more benefits than non-computer base. Computers base organisation of data is more durable as it is stored on a simply file computer or storage hardware. This may be difficult for non-computer base as the new data will require more physical space. Another reason is that with computer base, search queries software are installed for very time effective way of direct access of data. Due to its able to be arranged in order to the clients liking and search bars, it will allow for easier control of managing and accessing data, unlike non-computer which are hard to manage will the stack of data, leading to a difficulty in locating and sorting data. ▪ However non-computer based databases are helpful for smaller storage of data, such as dictionaries and telephone books. They have more security when in cyber storage and sometime will provide a more secure place to store data.
▪ Identify situations where one type of databases is more appropriate	

than another	
▪ Represent an existing relational database in a schematic diagram	

4. Storage and Retrieval	
Students learn about:	*Notes:*
▪ Database management systems (DBMS) – The role of a DBMS in handling access to a database – The independence of data from the DBMS	▪ Data need to be secure and efficient to access for storage and retrieval of information from a database. ▪ Database management systems [DBMS]: A tool for accessing large databases. It is a software that allows users to gain access of the database, as well as edit, maintain and view the data, ▪ Difference between Database and DBMS: Databases merely contain the data; DBMS provide the access to the data. ▪ DBMS separated the data and it management. The separation of data and processing is known as Data Independence. The data is independence, hence altering or editing it won't affect or change the software application. – The role of a DBMS in handling access to a database ▪ DBMS is a software application that provides access to a database. With this access, users can edit, manipulate, sort and search for the independence data. ▪ In a DBMS, data is organised into tables, viewed in forms, retrieved using queries and displayed in reports. [All these are forms of databases views]. ▪ SQL statements are used in database for searching specific data. – The independence of data from the DBMS. ▪ Data Independence: The DBMS, doesn't hold any data, but is there for viewing. Thus changing the data won't affect the DBMS.
▪ Direct and sequential access of data	▪ Direct and Sequential access of data are two of the main ways for accessing data. Another is Indexed access. – Sequential Access: Data is stored and retrieved in a linear sequence. In other words, data is accessed in the order it was stored. Thus, doesn't require an exact location. ▪ This makes is time consuming if the organisation has a large database. ▪ The only hardware using this method of accessing data is magnetic tapes. – Direct Access: Can go to any data in any order, without having the need to access previous data items. It means the data must have a storage location based on algorithm. [Once the data's location is known, then that data can be read and edited directly]. ▪ When the algorithm, data's storage is calculated and located, but if the data is not found in that location, then the computer

	searches through other location until the data is accessed. – Indexed Access: Based on the word Index. When the direct access involves the use of an index. Data is accessed by referring to the index and obtains its location. This may require more time to search. ▪ Direct method is the fastest method of accessing data in Databases, followed by Indexed, then Sequential.
▪ On-line and off-line storage	▪ Data can be stored off-line on a hardware, or on-line in a cloud. – Off-line Storage: This is when data cannot be access without a connection to a drive, or is mounted on a drive. ▪ Examples: Magnetic tapes, Thumb drives, or USB. ▪ In information systems, off-line storage is used for backup copies or secure access without the need of the internet. – On-line Storage: Doesn't necessary access to internet. On-line Storage is available immediately with a connection to a computer. ▪ Examples: Hard disk in a computer, storage device in a network, or the internet [Dropbox, ICloud]. ▪ On-line storage over the internet is becoming popular; with third party organisation developing secure, flexible service. Also providing backup and restore setting. This however, arise the social and ethical issue of privacy of an individual.
▪ Centralised and distributed databases	▪ Centralised and distributed databases: – Centralised Database: Has one database located under one DBMS. ▪ All user and clients can only access the database from that single source. ▪ This arises the problem of increased user accessing one database, which causes for communication line failure or slow response time. ▪ "One of HSC definition": Allows different locations to access data from a single source. – Distributed Database [DDBMS]: Multiple databases are split around different locations/sites. Having one central Database as its main source. Updates and change to any of the database from any location will be synced with the central one and updated on all other databases. ▪ All the data acts as one whole database but is geography spread out. ▪ Although Centralised databases is difficult to obtain a complete view of the whole databases and is more complicated overall, it reduces data transmission cost that would occur in Centralised DB. ▪ Types of Distribute DB include, Fragmentation, Downloading, Replication. ▪ "One of HSC definition": Allows different locations faster access to relevant data.

▪ Storage media including: – Hard discs – CD-ROMs – Cartridge and tape	▪ Storage Media: – Hard discs: Hardware that is usually fixated inside a computer. They are made out if metal and glass covered by magnetic material. HD uses direct access to obtain data, since data is arranged in each platter into tracks into sectors laid in a concentric circle. Each sector holds an x number of bytes, in an x number of tracks in an x amount of platter. Their storage is usually measured in GB. – CD-ROMs [Compact Disc-Read Only Memory]: Plastic disk with a reflective layer of metal covering the surface. Data is read and written using laser technology made of pits and lands. Light is reflected from the disk to determine 0 or 1. CD uses direct access to obtain data CD-ROM is an example of Optic disk, which also includes, DVD and writable CDs. – Cartridge and tape: Old fashion Hard disk encased in a plastic cartridge, around the size of a matchbox. These cartridges can be removed. They can store large amount of data [usually made for backup] and are cheap. Cartridge used direct access – Magnetic Tapes: Magnetic tapes have similar features to cartridges and tape. They are long thin strips of plastics. They can large amount of data inexpensively. They unfortunately use sequential access to retrieve data, making slow.
▪ Encryption and decryption	▪ Encryption / Decryption is a **security method for data, a**s the process of encoding data, then decoding it **aims to make the data difficult to decode** but also practical to use. ▪ Data is encoded [Encryption] ➔ Transmitted ➔ Data is decoded back into its original data [decryption]. ▪ Two main type of encryption: – **Asymmetric Encryption:** Requires a public and private key. The public key is accessible to everyone, but is only for encryption data. The private is for decrypting the data, and is available only to the receiver of the data. Common asymmetric encryption method is the Public Key Encryption. Where the public key is used to encrypt, and a private key is produce and kept secret in the encryption [via complicated number theory]. – **Symmetric Encryption:** Requires the same key for encryption and decryption. Not as effective as Asymmetric Encryption. Mainly used for storing data. Common symmetric encryption is Data Encryption Standard [DES].

▪ Backup and security procedures	▪ Data security aims to prevent data being lost or corrupted, and help block unauthorised access of data. ▪ Backup: A backup is a procedure that copies files [in DBMS, databases], and is stored in another location. Usually stored offsite or in a fireproof safe. This is done, to ensure data is lost encase of device failures or data lost. – Full Backup: All data on the system is backed up. This is the most effective way of backing up all the data, but is very time consuming and requires a large storage space. – Incremental Backup: Since data is backed up. It would be a waste to use full backup to back up some extras updates. Therefore, we have incremental backup, which allows data that was changed since the last incremental backup to be backed up. – This minimise the time and space required to back the updated data. Incremental is a daily procedure. Thus, the recovery process will take time as the backup are separated in pieces. – Differential Backup: This is when data is backed up like incremental. The data uses full backup to backup its data, then use the incremental backup on the next day. But the day after that it doesn't just updates that day's data which incremental backup would; instead backups the previous data and that data on the day. In doing this, it makes recovery of data easily in larger chunks of files. ▪ Security Procedure: Without security data, can be stolen, destroyed and altered. Methods of security data is encryption and decryption, backups, recovery process [All as mentioned above]. – Physical Security Measures: Climate control rooms, Access locks are methods of preventing unauthorised access from entering the room. – Usernames and Passwords: Having a username helps identify user and their assigned permission. This controls who gets to access what level of data. Added with a password can further secure files from hackers. – Firewalls: This method of security can be used for online purposes. It verifies and authenticates all incoming data and checks the password of anyone trying to access the network. Firewalls are hard and expensive to install, and may require one then one if it's a large organisation. – Restricting access using DBMS: Restricting access in Databases meaning that not the whole database is available to every user. Depending on their username and other authorities, users will have an assigned permission access to data. A view or user views is essential for SELECT queries in SQL. – Record locks in DBMS This method is implemented due to conflict between two users editing the same data at corresponding times. It will be hard to know which to stored. There are two types of locks: ▪ Pessimistic Locks: The first user to starting editing has control over the editing process, hence others trying to access the data

	must wait until the first user is done; then they can commence. This is often being portrayed with a symbol that someone is occupying that the data is being access and edited. ▪ Optimistic Locks: It assumes that conflicts will rarely occur. If conflict were too occurring, then one of two changes will definitely be lost. Usually a warning sign will pop up, stating either to overwrite or discard the current changes.
▪ Tools for databases storage and retrieval, including: – Extracting relevant information through searching and sorting a database – Selecting data from a relational database using Query by Example (QBE) and Structured Query Languages (SQL) commands - Select - From - Where - Order By	▪ Tools for databases storage and retrieval, including: – Extracting relevant information through searching and sorting a database ▪ Search: To look through the database and retrieve the required data. A search needs to be quick and efficient when locating and retrieving the data. The ways of searching through a database is manually browsing through a table or using the Find and Search command. For a large database, most efficient way of searching is via query. ▪ Sort: To arrange the data in a specific order. [Alphabetical, Numerical, ASC or DESC]. This makes the database always easier to use, when data is arranged, rather than randomly data in a table. ▪ Tools for searching and sorting are Indexes and query. – Selecting data from a relational database using Query by Example (QBE) and Structure Query Language (SQL) commands ▪ **Query by Example [QBE]:** This is a visual method of retrieving data and doesn't require the knowledge of SQL. – QBE is simpler than SQL, as one mistake in SQL will stuff the whole search query, yet this much more understandable. – Two main reason for QBE: 1. It much more easier and quicker 2. Allows the users to see SQL without understanding them. [Abstraction: Hide the technical process. Giving users interaction with query with SQL, yet hiding the technicality of SQL]. – Example of visual QBE is Advance Setting in Google or Filtering. – In SQL, the query is command line interface. ▪ **Structured Query Language [SQL]:** is a specialised language designed to search databases. – SQL statement are used to perform certain tasks, In this scenario 'Select Statement contain keywords like SELECT, FROM, WHERE and ORDER BY. - **Select:** Listing of the desired Attributes/Fields. E.g. SELECT Firstname, Lastname, DOB - **From:** This is where the source of data come from in the select statement. [Which tables are the selected field from?]. E.g. Since we SELECT Firstname, Lastname, DOB. These are usually from the table Students. Thus, we have, FROM: Students

	- **Where:** The condition of the data. What criteria are needs to satisfy need to display these data. E.g. We want all the last name with Smith to be selected. If you criteria is a text. IT MUST HAVE QUOTES. WHERE: Lastname = "Smith' - **Order-By:** This is last part of the select statement, which identifies how the data will be ordered. E.g. We want all their firstname to be **Ascending/Descending** order respectively. ORDER-BY: Firstname **ASC/DESC** ▪ Relational Operators: Indicates the relationship between two expressions. This is used in the 'WHERE' part of a select statement. – = [Equal], <> [Not equal], < [Less than], > [Greater than], <= [Less than or equal to], >= [Greater than or equal to]. E.g. WHERE: Student.Lastname = "Smith" ▪ Wildcards Characters: Allow searches to be more flexible – * ➔ any set of characters E.g. WHERE: Student.Lastname = "S*" This will you anyone with the Lastname starting with S. – ? ➔ single unknown characters E.g. WHERE: Student.Lastname = "Sm?th" This will give all the Lastname with Sm_th in it. Could be Smith or Smuth, Smeth. ▪ **Logical Operators**: Used to combines queries so that searches is carried out on more than one field. – A AND B ➔ Wants A and B to be fulfilled simultaneously/true. – A OR B ➔ Want either A or B to be true. Can have both. – A NOT B ➔ Want only A. Exclude any B. – A XOR B ➔ X stands for exclusive [Similarly to 'OR'] [XOR can only have A or B, but can't have both] [THIS IS RARELY USED].
▪ Tools for hypermedia search and retrieval, including: – Free text searching – Operation of a search engine - Indexing and search robots - Metadata	▪ Data is retrieved from a database using data structure and the relationships between them. It involves search engines. – Free text searching: Searching a computer based document or database for characters and words. – Operation of a search engine - Indexing and Search robots ▪ Search engine: A search engines is a database and a program that build of an indexed website, that allows keywords search. ▪ An index us a table containing information about the location of data. The search engine is built by regularly scanning the Web for new sites and accepting submissions form web page authors. This scan is usually done by a program known as a spider. They send back URL of all the relevant websites to the search engine.

	▪ Indexes allow documents to be found usually keywords search. The general processes performed by Search Engines ➔ Spiders: **1.** Crawling the Web to locate and retrieve web pages relevant to the topic. **2.** Indexing and ranking each web page found. **3.** Analysing search criteria entered by users. **4.** Retrieving suitably ranked web page results on the search engine. ▪ Two techniques to locate web pages: – Web Directories: Old fashion method of locating web pages, as humans manually handpick relevant webpages and place them in the right categories. ▪ When a new website if create, it information is sent to the web directors, and the results are check by an employee who then allocates the site in an appropriate directory. ▪ Having web directories can have bias notions, time consuming is not a static place. ▪ But using a web directory will provide you will the most relevant searches, as irrelevant websites can appear in search engines. – Search Engines: Uses an automate software known as search robots [Spiders]. These robots crawl the web and locates and index webpages to search for the relevant websites. - Metadata: This is where a table of data defines the data and makes the description of the data.
▪ Reporting on data found in Hypermedia system	▪ A report is a formatted and organisation presentation of the data. ▪ In

Students learn to:	*Notes:*
▪ Search a database using relational and logical operators	▪ A
▪ Output sorted data from a database	▪
▪ Generate reports from a database	▪
▪ Construct an SQL query to select data from a given database, matching given criteria	▪

5. Other information processes for databases information systems	
Students learn about:	*Notes:*
▪ Displaying: – Reporting on relevant information held in a database – Constructing different views of a database for different purposes	▪ **Displaying:** – Reporting on relevant information held in a database ▪ A report is the formatted and organised presentation of data. ▪ The selected data from queries made is put into report form [tabulated layout or column layout]. So, before a report can be made, the user needs to select the required records by constructing queries. ▪ Most DBMS reports have these following sections – Report header: Appears once in the beginning of report. Contains Logo, report title and date. – Page header: First page of report will contain title, column headings or any report headings. – Details: The details section contains most of the information. – Page footer: Displays on the bottom of page the date and page number. – Report footer: Appears at the end of reports, displaying the items such as report totals. – Constructing different views of a database for different purposes. ▪ Different views of a databases are obtained using a form. ▪ Form View: Used to view, enter or change data in a table. [Used in access to make Baker's D]. ▪ A well-designed form provides information explaining the required data and any rules that apply to the field. ▪ Table View: All the data is displayed in a table. Basically, like an overview of the data. ▪ Report view: Used as a summary format and is output data by printing.

Students learn to:	*Notes:*
▪ Design and create screens for interacting with selected parts of a database and justify their appropriateness	
▪ Design and generate reports from a	

databases	

6. Issues related to information systems and databases	
Students learn about:	*Notes:*
▪ Acknowledgement of data sources	▪ [Acknowledgement of data source] ▪ Data source: The source of the data is the individual or organisation that developed the data. Thus, they have full ownership of the data. ▪ The source of data is protected by the Copyright Act. ▪ People who doesn't have permission to the database, can't simply not copy ot alter the data to their likings. It's against the law to violate copyright. ▪ To be able to use data and information, owner of the data must acknowledge that their data and work can be used. ▪ For students, information can be used or research or educational purposes. It is appropriate if the student cites the work. To cite an internet source, they must include: Author's full name, title of the complete work or webpage, URL, date of document publication.
▪ The Freedom of Information Act	▪ [The Freedom of Information Act] ▪ This issue affect the governments information. ▪ Gives people the right to obtain access to government information about themselves, and allows them to change and update. ▪ Free of Information Act is designed to allow individuals to what kind of data is being kept by the government or officials.
▪ Privacy Principles	▪ [Privacy Principles] ▪ The privacy principles help protects individual's personal information from unauthorized access and corrupted. ▪ It enforces the organisation to state why they are collecting the information, and how they will manage it. Making sure that they don't mislead or spam you with other promotion by other organisation or selling the information. ▪ Privacy Act, or in other words, privacy of an individual.
▪ Quality of data	▪ [Quality of Data]

▪ Accuracy of data and the reliability of data sources	▪ [Accuracy of data and the reliability of data sources] ▪ Accuracy of data is important so issue doesn't arise or jeopardise the organisation. ▪ Data validation: is used to check if the entry data meets the data type. ▪ Data Integrity: describes the reliability of the data. It makes sure that the entry data, is accurate and relevant.
▪ Access of data, ownership and control of data	▪ [Access of data, ownership and control of data] ▪ Many databases store private information on individuals. Thus, control must be enforced to restrict data access from other organisation taking for their own benefits.
▪ Data matching to cross link data across multiple databases	▪ [HAVE NOT LEARNT YET]
▪ Current and emerging trends in the organisation, processing, storage and retrieval of data	▪ Current and emerging trends – Data Warehouse: is a large collection of databases source used by an organisation. ▪ It is a storage of every data entered from the beginning to the present. Ranging from historical data to every single activity done by the organisation. ▪ The copy of all the different data is used to analysis and assist organisation to make decisions by seeing trend and emerging patterns within different database. – Data Mining: is analysing the data, for advantages. ▪ This is a much more sophisticated approach to obtaining information about the trends of an organisation. ▪ The aim of Data mining to look at relationships and patterns in the data. ▪ Data mining gives new discovery to knowledge about the strategies within the data, ▪ Downside to Data mining is that these patterns occur by chance unlike data warehouse where all the previous provide a solid trend and relationship in their progress. – Online Analytical Processing [OLAP]: Is a technique for providing business decision makers with statistical evidence, largely based on past rends and historical data. ▪ OLAP aims to provide critical information visually, online, as needed and as quickly as possible. – Online Transaction Processing [OLTP]: We don't learn this. ▪ OLTP systems are databases that allow transactions of remote users to be processed immediately (in real time). Completing a transaction online is an example of a transaction performed by an OLTP system. A transaction is a sequence of operations that must be completed successfully or it will fault. E.g. ATMs, online banking.

	Students learn to:	*Notes:*
	▪ Identify and apply issue of ownership, accurancy, data quality, security and privacy of information, data matching	
	▪ Discuss issues of access to and control of information	
	▪ Validate information retrieved from the Internet	