

## Information and Communications Technology

### Systems

#### Data

##### Bullets

- Data are raw facts and figures.
- On its own data has no meaning.
- Data may be inputted and stored in a computer.

##### Text

Data are raw facts and figures. These raw values could be numbers, characters, transactions, dates, true/false values, symbols or readings from sensors. On their own they have no meaning, but they may be inputted and stored in a computer.

Example:

MS, 1:26.261, FA, 1:25.683, JB, 1:26.260, RB, 1:26.233, GF, 1:25.994, KR, 1:26.255

These values may be easily stored in a computer database, spreadsheet or text file. As they stand they have no significance or value.

##### Questions

1. What is data? 2. In what form may data be stored?

##### Keywords

data

#### Information

##### Bullets

- Information is processed data.
- Information has a context which makes it meaningful.
- Computers output information.

##### Text

Information is data that has been processed by a computer. It is what the computer outputs. Information has a context which makes it meaningful.

Example:

FA, Fernando Alonso, 1:25.683

GF, Giancarlo Fisichella, 1:25.994

RB, Rubens Barrichello, 1:26.233

KR, Kimi Raikkonen, 1:26.255

JB, Jenson Button, 1:26.260

MS, Michael Schumacher, 1:26.261

The data has been processed by sorting the lap times in ascending order, fastest first, and a lookup has been used to find the full names of the drivers.

##### Questions

1. How may data become information? 2. Suggest different processes that may be applied to data.

##### Keywords

process output context

#### Knowledge

##### Bullets

- Knowledge can be gained by interpreting the information obtained by processing data.
- Basis for informed decisions.

##### Text

Knowledge is derived from information by applying rules to it i.e. it is what you get when you interpret information. Knowledge is using information to make decisions. To summarise: knowledge can be gained by interpreting the information obtained by processing data.

Example:

01 Fernando Alonso 1:25.683

02 Giancarlo Fisichella 1:25.994

03 Rubens Barrichello 1:26.233

04 Kimi Raikkonen 1:26.255

05 Jenson Button 1:26.260

06 Michael Schumacher 1:26.261

From the above list we may now structure the race grid for the 2005 Australian Grand Prix. We know who qualifies for pole position for the race as they drove the fastest qualifying lap time. If we were to add further driver details and interpret the information we would be able to work out which car manufacturer is performing best, which driver is having a good day, who is consistently within the top six grid places in the race series, who is off the pace on the day, which tyre make is performing best on this particular circuit, etc.

### Questions

1. How may data become knowledge? 2. What is knowledge? 3. What is meant by interpreting information?

### Keywords

knowledge derived interpret decisions

### **Encoding Data**

#### Bullets

- Data types: Boolean, Integer, Real, Text/String.
- Encoded data is data replaced with short codes.
- A value judgment is a way of encoding opinion.

### Text

#### Data Types

- Boolean - Can hold one of two values, e.g. Yes/No, True/False, Male/Female, 1/0
- Integer - Holds whole numbers, e.g. 1 2 3 4 5
- Real - Holds decimal numbers, e.g. currency, 1.25
- Text/String - Holds any alphanumeric character, including letters, numbers and symbols

#### Encoded Data

Encoding means to replace data with short codes.

Examples:

- Male/Female encoded as M/F
- Red/Green/Blue encoded as R/G/B

#### Value Judgments

Situations arise where there is no absolute agreement on the value of a data item. When this happens a value judgement has to be coded for computer input. A value judgement is a matter of opinion rather than fact. Example: the following data may be collected on a dating agency form - I am: handsome / good looking / average / ugly

With value judgements there may be no single correct value, the value depends on someone's opinion. Coding of value judgements will inevitably lead to coarsening of data since there will be a wide range of opinions that could be held, and only a limited number of codes available.

### Questions

1. What data types are the following: a) £9.95 b) True c) Record d) 100 2. What is encoding? 3. When referring to value judgments, what is meant by coarsening of data? 4. Why with value judgments should there be a minimum of codes?

#### Keywords

boolean integer real text/string encoding value judgment coarsening of data

#### **Advantages and Disadvantages of Encoding Data**

##### Bullets

- Encoding saves memory.
- Faster manual input.
- Less transcription errors.
- Consistency of data.
- Shorter comparisons for searches.
- Coarsening of data.
- Need to understand the codes.

##### Text

#### Advantages of Encoding

- Less storage space is required - saves memory
- Faster manual input
- Less chance of transcription errors - allows checking of data entry against known list of valid values e.g. lookup
- Greater consistency of data
- Comparisons are shorter thus speeding up searches
- A limited number of codes ensures that when a search condition is specified it will be in the same terms as the data is stored

#### Disadvantages of Encoding

- The precision of the data may be coarsened through value judgments - e.g. colour
- The user needs a list of valid codes and their meanings to understand the encoding

##### Questions

1. What is the main danger of using value judgments? 2. How are database searches made faster by using coded data?

#### Keywords

consistency precision coarsening

#### **Value of information**

##### Bullets

- The monetary value of information depends on its accuracy and intended use.
- Access to valuable data must be controlled.
- Information has value when it:
  - Aids decision making and planning
  - Monitors progress
  - Aid targeting and strategy making
  - Gains an advantage over competitors
  - Records Transactions
  - Measures performance

##### Text

The monetary value placed on information depends on

- the accuracy of the information
- the intended and potential uses of the information

Access to commercially valuable data must be controlled as a potentially valuable resource could be stolen or damaged. A company may have sensitive commercial information and would not want its rivals to gain access to it, so may restrict access to the data. Information is often in the form of money transactions which must be kept secure from loss.

Information has value when it:

- Aids decision making and planning
- Monitors progress
- Aids targeting and strategy making
- Gains an advantage over competitors
- Records Transactions
- Measures performance

#### Questions

1. How can a value be placed on data? 2. Why is access to commercial data sensitive? 3. Why does the value of information rise when linked with strategy making?

#### Keywords

#### **Direct and Indirect Data Collection**

##### Bullets

- Direct Data Collection happens when a company gathers its own information.
- This data may be gathered automatically or manually.
- Indirect Data Collection happens when a company buys its information from another source, or pays a third party to collect the data.

##### Text

Direct Data Collection happens when a company gathers its own information. This data may be gathered automatically or manually:

##### Automatic collection

- Transaction of bar-coded item at an EPOS terminal
- Automated sensors gathering patient's vital signs in a hospital
- Automated school attendance register

##### Manual collection

- A customer completing a customer satisfaction survey form
- Voting at election time

Indirect Data Collection happens when a company buys its information from another source, or pays a third party to collect the data. Data Protection issues may arise if data is used for purposes not originally intended. Supermarkets employ market survey specialists to gather customer data. E-commerce websites give customers the option of whether they want their details passed on to advertising companies.

#### Questions

1. Why would companies buy information from another source? 2. What is the disadvantage to the customer of a company selling on their details? 3. How does direct data collection benefit the supermarket customer? 4. Why do

schools use automated attendance registers?

#### Keywords

direct indirect automated

#### **Cost and Human Resources**

#### Bullets

- 3 main cost categories: money, time, human resources.
- There are direct costs in obtaining information.
- There are costs in processing data.
- There are costs in ensuring that data is up to date.

#### Text

Costs fall into 3 categories:

- Money
- Time
- Human resources

There are direct costs in obtaining information. This may vary from installing new EPOS tills to paying for a survey to be done.

There are costs involved in processing the data within an organisation. This may be the cost of installing a computer system and its peripherals or sensors, and training and employing staff to run the system.

There are costs in ensuring that the data is up to date since most data becomes less accurate with age. People on mailing lists move or die or their circumstances change. People's answers to a questionnaire may be different a year later.

There are ongoing costs to update the data that the information is based on. This may be:

- Labour intensive - e.g. wages, hours worked
- Hardware intensive - e.g. maintenance, upgrading storage, or increase hardware
- Both - e.g. supermarket stock control where goods are barcode-scanned at the EPOS but a manual check of shelf contents is needed on a regular basis to allow for stock that is stolen, broken, out of date, or otherwise removed from the shelf

#### Questions

1. How can data become less accurate with age? 2. Name 3 direct costs in obtaining information. 3. What are the dangers to a company if data becomes too expensive to update?

#### Keywords

valuable data accuracy sensitive information

#### **Quality of Information**

#### Bullets

Good quality information is:

- ☑ reliable
- ☑ accurate
- ☑ up-to-date
- ☑ complete
- ☑ precise
- ☑ comprehensible
- ☑ GIGO

#### Text

Good quality information is:

## Reliable

- The data can be trusted
- The original source is known

## Accurate

- Inputted without mistakes or transcription errors

## Up-to-date

- Collected recently
- Different types of data age in different ways

## Complete

- No missing data

## Precise

- Does it contain exactly what you want?
- How much waste needs processing?
- Correctly targeted

## Comprehensible

- Can you make use of it?
- Is the data too complicated for the purpose?

## GIGO

Garbage In - Garbage Out.

If data is not worth having then the information it generates is also not worth having.

### Questions

1. How may data be trusted? 2. How can transcription errors be avoided? 3. How may Garbage In be avoided?

### Keywords

reliable accurate up-to-date complete precise comprehensible GIGO

### **Data Entry**

#### Bullets

- Management Information System (MIS)
- Automatic data collection.
- Manual data collection.

#### Text

The Management Information System (MIS) used by a company usually dictates how data is collected. The most common type of automatic data collection occurs during the financial transaction of buying goods, e.g. when a bar-coded item is sold at an EPOS terminal in a supermarket. Data may be collected manually on a form when a customer pays their household energy bill. Data may be collected on printed forms and manually entered into a computer using a keyboard, e.g. entering survey data collected by questionnaire. Data may be collected on an OMR or OCR form for direct data entry by means of a scanner e.g. lottery ticket numbers. In certain situations data can be collected using

sensors from an automatic weather monitoring station.

### Questions

1. What type of data entry is barcode scanning? 2. Which input devices are used during manual entry? 3. Why do hospitals use automatic data collection in intensive care wards?

### Keywords

### **Validation and Verification**

#### Bullets

- Validation - Correct Type
- Verification - Accurate
- 6 Validation Methods
- Range check
- Presence check
- Check digit
- Length check
- Format check
- Fixed Value / Drop Down Menu
- 
- 3 Verification Methods
- Comparing data
- Double Entry
- Proofreading
- 
- Data errors can occur during input, transcription transmission and processing

#### Text

A company needs information to be as correct as possible. To make sure information is correct validation and verification checks are used

How data errors can occur:

Input errors - some examples of error during input are customers filling in the details on the data entry form incorrectly, forms being lost, forms being entered twice, problems with input devices.

Transcription errors - These happens when data is being inputted into the computer. Types of error here are, Misspelling a street name, mistyping a phone number.

Processing error - these occur after data has been inputted. For calculated fields that depend on inputs, an incorrect formula will produce the wrong answer every time.

Transmission error - sometimes when data is transmitted from one location to another it may not arrive due to network problems.

Data Validation means checking the data entered is reasonable. Data Verification ensures data is accurate.

There are two different types of problems with data: invalid data and inaccurate data. Invalid data is data that cannot be true, e.g. someone's date of birth being 19/09/2090. Inaccurate data is valid data that is not correct, e.g. someone's recorded date of birth is 23/10/1994, but actually it is 24/10/1994

#### 6 main types of Validation

Range Check - The data must be a value that falls between two predefined values, e.g. Date of Birth of a student in a school would have to be between 01/09/89 and 31/08/96, any other date should be rejected.

Presence Check - A presence check requires that a value must be entered, e.g. every patient in a hospital needs an admission number, if the person inputting information about the patient leaves that specific box empty, the computer should tell the user to fill in that field.

Format Check - The data must conform to a prescribed layout (specific numbers or letters), e.g. Date of Birth being 01/01/1980 means the format is dd/mm/yyyy, any other format should be rejected.

Data Type - The data must be of a specific type (number, text, boolean, etc.), e.g. data entered for "No. of stock" must be a number. Any other data type should be rejected.

Fixed Value / Drop down - The data must conform to one of the values in a predefined list, e.g. In a gender field, you can only be Male or Female.

Check Digit - This is a way of checking for transcription errors in long numbers (ISBN code of a book), the check works by performing a mathematical calculation on the code number and returning an error if expected value isn't the same as actual value

### 3 Verification Procedures

Double Entry - Two different people enter the same data into two different computers. The verification program then compares the two sets of data and identifies the mistakes

Sending Back Printouts - This is when a company would send printouts of inputted data to the data source and ask them to confirm the accuracy of the data

Proof Reading - Proofreading is reading a proof copy of text for the purpose of detecting errors.

### Questions

1. Explain how 2 different Validation checks actually work? 2. Define Data Verification. 3. What is invalid data? Give 2 different examples of invalid data? 4. Name and describe one validation method and one verification method used in on-line banking systems.

### Keywords

Validation Verification Invalid Data Inaccurate Data Validation Checks

### **Advantages of ICT - Processing**

#### Bullets

- Increases in the speed of processing have made new developments in medicine possible - such as scanners (MRI, CAT etc) which involve collection and processing of huge amounts of data.

### Text

#### REPETITIVE PROCESSING

Computers do not get tired or bored, work 24/7 automatically and process data extremely quickly. This is ideal for jobs where the same task is repeated repetitively (batch processing); for example, printing bank statements for 5000 customers is made very easy. Computers can be programmed to work without an operator.

#### SPEED OF PROCESSING

The speed of computer processors is doubling approximately every 18 months. Speed has allowed the use of simulation programs to model real-time situations such as flight simulators. Speed of feedback (response) is also important in control applications. Video games rely on speed of processing for life-like motion and screen refreshing etc. A large number of forms can be read quickly by an OCR (Optical Character Recognition) scanner

- Speed of processing allows for intensive-care monitoring of patient's condition, with on-screen moving images (CAT and MRI are other examples of medical systems that depend on massive computer processing to generate images from directly captured data - speed is crucial in providing doctors with detailed results quickly).

### Questions

1. The speed at which data can be collected and processed has increased dramatically over the years. How have these changes benefited hospitals?

### Keywords

batch processing simulation programs feedback control intensive-care CAT MRI

### **Advantages of ICT - Speed**

#### Bullets

- Computers allow vast amounts of data to be searched easily.
- Databases can be searched easily through input of keywords.

- Medical databases include Patients' Case Studies and pharmacology (medicines)

### Text

#### SPEED OF SEARCHING

Very fast searching through file directories is possible, and the user is able to locate files based on filename, date of creation or on particular strings of text within the file. This high speed makes Internet searches possible, using a Web Browser and Search Engines

- Medical databases such as Pharmaceutical databases, Patients' Case Studies and Organ Donor databases can be searched rapidly, simply by entering key words

#### ACCURACY AND SPEED OF DATA COMMUNICATIONS

Apart from hardware failure or bugs, computers are much more accurate than humans - and they do not get tired by repetitive tasks. If the same data is entered twice, a computer will give the same results - but humans rarely do. Direct capture (data logging etc) avoids human error. The speed of communications across a link is important for file transfer. Broadband connections to the World Wide Web (www) make transfer of large files (graphics/ video etc) possible, and without broadband the speed could prove inadequate for the volume of traffic

- A radiologist can receive x-ray scans via the WWW directly at home - and can work for several different hospitals at the same time without time-consuming travel. (This would not be possible if he/she had to wait hours for each download)

### Questions

1. Using named examples, describe TWO different ways in which speed has played an important role in making the Internet more usable. 2. What is meant by 'Direct Data Capture' and why is this more accurate than manual methods?

### Keywords

web browser search engine data-logging broadband

#### **Advantages of ICT - Data storage and outputs**

### Bullets

- Vast amounts of data can be stored in very little space using memory or backing store.
- Important in medical applications such as scans (MRI, CAT, X-ray etc) where huge amounts of data collected.

### Text

#### DATA STORAGE CAPACITY

A vast amount of data (such as is necessary for graphics) can be stored in computer memory or on back-up store (Hard Disk Drive or CD-R etc). This removes the need for bulky filing cabinets

- Hospitals are now storing x-ray images, CAT scans, MRI scans and ultra sound video etc. as digital computer files. This requires very large storage capacity, especially for colour graphics and video images

#### ABILITY TO PRODUCE DIFFERENT OUTPUT FORMATS

Data can be combined and output as graphs, charts, reports, graphic images, moving video or even sound. One example is school attendance data, which can be printed out once a week as a report with graphs

- Intensive Care, where heart/ pulse monitor results can be output as sound wave, moving graphical screen image, or as a printed statistical report.

### Questions

1. Modern computer systems are capable of storing huge amounts of data. Explain why this is so important to a hospital department which specialises in patient diagnostics such as MRI, CAT scans or ultra sound. 2. Imagine that you are a doctor working in an Intensive Care unit: state FIVE different outputs that would be available to you in order to monitor the condition of your patients?

#### Keywords

hard disk drive CD-R backing store

### **Efficiency of Data Processing Systems 1**

#### Bullets

- The efficiency of a computer system is affected by:
- the hardware and software,
- the nature of the operating system,
- the way in which the computers interface with the user.

#### Text

##### **HARDWARE**

The Central Processing Unit (CPU), input devices, output devices, backing store and methods of capturing data all have an effect on the efficiency of a computer system. A system only runs at the speed (efficiency) of the weakest link. Many hardware devices could not be used fully until the speed of processors caught up with them. Out-of-date hardware cannot run latest software.

##### **SOFTWARE**

Good software has data portability (the ability to run the same software on different computer systems/ platforms) and backwards compatibility (the ability of software to work with earlier versions of itself). Features of good software are: search facilities, macro capabilities, application generators, editing capabilities, cut/paste, find/replace, short access times for data retrieval etc. Good software is also upgradeable, compatible and reliable. Poor software will restrict the effective working of the system, slow things down and frustrate the user (being non user-friendly, error-prone and unreliable)

##### **THE NATURE OF COMPUTER SOFTWARE**

It is important that software is suitable for the task

- A relational Database Management System (DBMS) would be suitable for a hospital where many departments need to access the data. (A flat file system would not be suitable because the same data would probably have to be typed in several times over, and would not be updated automatically if one department edited its data)

#### Questions

1. Using a named piece of computer hardware, describe how it could affect the overall efficiency of a computer system if it is much older than the other components. 2. One feature of good software is that it has 'data portability' - what is meant by 'data portability'? 3. Explain why a Database Management System (DBMS) is much more useful to a hospital than a series of flat-file databases.

#### Keywords

CPU data portability backwards compatibility of software application generators relational database (DBMS) flat file database

### **Efficiency of Data Processing Systems 2**

#### Bullets

- The efficiency of a computer system also depends on its operating system and the interface between computer and user.
- If the user enters incorrect data, then the system is bound to output wrong information - GIGO.
- Expert Systems can help save valuable doctor time by making initial diagnoses but cannot (as yet) replace doctors entirely.

## Text

### SUITABILITY OF THE OPERATING SYSTEM

The choice of the Operating System (OS) is important for the computer. A 'Command-driven' OS such as DOS (Disc Operating System) can be fast to use but needs to be learnt. Operating systems with a Graphical User Interface (GUI), such as 'Microsoft Windows,' are more user-friendly but involve a large amount of programming code. A good OS allows multi-tasking, management of RAM, storage of files, security procedures etc.

### COMMUNICATION AND INPUT - GIGO

Computers only do what they are told to do, and can only process the data entered into the system. If given wrong data, they output wrong information - GIGO (Garbage In Garbage Out). This may be a factor of user-tiredness and/or linked to poor software, and computers need to have data control mechanisms in place (validation and verification techniques) to spot these errors. Computers are not good at what humans do best - using Voice Recognition Software, for example, a computer can be trained to recognise thousands of word and sentence combinations, but still cannot detect sarcasm!

- Medical Expert Systems are getting better at diagnosing problems but may miss the obvious, such as a slight discolouration of the skin, something which even the patient may not have noticed!

## Questions

1. Computers are limited by the accuracy of the data they process, hence the expression GIGO (Garbage In Garbage Out) a. What exactly does GIGO mean? b. What precautions could be taken to ensure that the data collected in a doctor's surgery is accurate? c. What precautions should be taken to ensure that a patient in Intensive Care is being monitored accurately? 2. The National Health Service has introduced an on-line 'expert system' for people feeling unwell. a. What is an 'expert system'? b. How can an expert system help reduce the work-load of doctors? c. Why can't expert systems replace doctors entirely?

## Keywords

operating system graphical user interface (GUI) multi-tasking GIGO validation verification voice recognition expert systems

## **System Development**

### Bullets

- System upgrades are bound to be disruptive to normal working.
- Various options exist as to how to carry out the upgrade and IT managers need to consider these before upgrading
- Once the new system is in place, it will need to be maintained.
- The new system will increase need for maintenance.

## Text

### SPEED OF IMPLEMENTATION

This is a factor to take into account when deciding on which installation method to use for a new network, because delays may mean interruptions to the normal working of the organisation. It may be necessary to choose between a parallel installation, a phased installation, a direct changeover or pilot conversion.

### COMPATIBILITY

This is a factor to consider when installing or upgrading - is the new network compatible with existing systems and software? Will it still be possible to share files across the system? Will upgrades to existing stock be necessary?

### INSUFFICIENT TESTING

Microsoft Windows XP, for example, has over 40 million lines of code. It is impossible to test every possible combination of key press in a new piece of software, especially if there is a rush to beat competitors to be first on the market. Software bugs and poorly designed systems allow security loopholes which hackers can exploit, causing havoc on the world wide web.

### POOR COMMUNICATIONS WITH THE USER

A good User Interface (UI) is vital if the system is to be used effectively. Error trapping and on-screen warnings are important features of good UIs. The ability of software to communicate problems back to developers helps fix

problems in later upgrades (Office 2003 software 'dials out' to Microsoft to log problems).

#### ABILITY OF THE USER

This will affect the efficiency of the system directly, and needs to be taken into account when designing the software interface.

#### POOR POST-IMPLEMENTATION PROCESS

Once a new system has been installed and is up and running (implemented) it is essential that a system of reviewing and trouble-shooting of problems is in place as part of the Systems Analysis cycle. It is bad practice to implement a system and leave customers to sort out the problems that may develop as result.

#### MAINTENANCE PROCEDURES

It is essential that maintenance is carried out regularly on computer systems (Systems Maintenance). Repairs and/or replacement of faulty hardware is essential for continued efficiency. Reviews of the operation of individual components within the system will highlight needs for upgrades to software/ hardware etc. (Is the backing store still big enough to hold all data? Do the printers cope with the increased demand?). Corrective Maintenance corrects bugs. Perfective Maintenance involves adding extra features in order to enhance performance of the system. Adaptive Maintenance makes changes to a system as a result of modifications to the original requirements

- Backup procedures are essential to maintain the integrity of data. (For large organisations this is fully automated and carried out daily - special software is required to back up files and recover lost data)
- Most schools have maintenance contracts with local suppliers for technical support and fixing hardware and software problems on a daily/ weekly basis. (They also employ full-time technicians for maintenance of system/ security issues/ installation of software/ user account problems etc)

#### Questions

1. When a new computer system is installed it may be set up as a 'parallel' installation, a 'phased' installation, a 'direct changeover' or a 'pilot conversion'. Explain what is meant by each of these different methods. 2. Even after a new computer system has been successfully installed, maintenance is essential. Maintenance may be described as 'corrective', 'perfective', or 'adaptive'. Explain what is meant by each of these different terms.

#### Keywords

parallel installation phased installation direct changeover pilot conversion error trapping systems maintenance (corrective, perfective and adaptive)

#### **System Maintenance**

##### Bullets

- Cost of upgrading or replacing computer systems is always a problem faced by system managers.
- Support from the supplier or manufacturer once a system is purchased/ installed is important and may be a factor taken into account when purchasing equipment in the first place.

##### Text

#### COSTS

On average, computers are only expected to last 3 - 4 years before they need to be upgraded. The cost of a system does not end with the initial purchase. The cost of replacement with new is often less than the cost of repair, because human labour (repair technician) is so expensive. It is important to future-proof purchases by not buying old technology (but at the same time, leading-edge technology is very expensive). Sometimes it is necessary to upgrade not because the hardware is performing poorly, but because the old software is not compatible with newer versions. This can lead to problems/ frustrations when exchanging files with other systems and other users. However, you do need to upgrade old hardware in order to run newer versions of software. Once a newer system is in place, other components start to show their age.

- One medical centre needed to upgrade to Microsoft Windows XP in order to maintain compatibility with other centres and to take advantage of extra security measures in the Windows Server 2003 Operating System. Unfortunately, over 20 of their older PCs were not capable of running Windows XP due to the memory and processor-speed requirements of the new software. It was cheaper to buy new PCs than to go to the trouble

of upgrading (replacing mother board/chipset, RAM, HDD and controller cards etc). A weakness in the server was then exposed, leading to further expensive upgrades of server, switches and automated backup system

The final cost of the 'software' upgrade was over £20,000.

#### SUPPORT

Software should be 'supported' by the manufacturer - via on-line help - for any problems that appear. There should be a way of contacting software technical support for problems that cannot be sorted through FAQs (Frequently Asked Questions) on the website. Regular 'patches' should be issued, to fix problems that have been identified since the launch of the software. Software should have 'context sensitive' help available on screen. User guides should be distributed with the software and/or be available on line. Failure of computer systems is common. Organisations need to have alternative plans/ backup systems (Disaster Recovery Plans) or the consequences can be severe.

- Records show that no major company can survive a data loss of more than three days
- In a modern supermarket, if the electricity fails the POS system fails. A backup power generator is triggered by the electricity cut and normally takes over, but if this also fails, shop has no alternative but to ask customers to give what they (the customers) consider to be a 'fair price' for their trolley load. Working out individual totals with a calculator would take far too long and be detrimental to customer relations
- In hospitals, loss of electricity would be life-threatening. For example, machines in intensive care would stop monitoring/working. Electrical backup systems are essential

#### Questions

1. When buying new computer equipment, what is meant by 'future proofing?' 2. A company selling computer systems may support its products with on-line help. This may include FAQs and 'software patches'. Describe how each of these features might be used to solve a problem with a new computer system. 3. In relation to computer systems, explain what is meant by a 'Disaster Recovery Plan' and why one would be essential for either a) a supermarket or b) a hospital.

#### Keywords

frequently asked questions (FAQs) disaster recovery plans

#### **Word Processing/ Desk Top Publishing**

##### Bullets

- WYSIWYG
- Frames
- Style sheet
- Template
- Embedded
- Indents
- Postscript files
- Mail-Merge
- Header and Footer
- Automated Page Numbering
- 

##### Text

Definition:

Using a personal computer to produce high-quality printed documents.

Main functions:

1. Editing: Documents can be saved and edited later (re-drafted) without the need to retype the whole document. They allow the user to see on-screen exactly how the document will appear when printed out. This is called WYSIWYG ("What You See Is What You Get."). DTP employs Frames into which individual blocks of text or images are placed, and

these frames can be moved around the screen without upsetting the layout of the rest of the document

2. Formatting: Documents can use different font styles (typefaces), font sizes and font colours. Line spacing, paragraph indents, backgrounds, borders and shading, bullets points and numbering are just some of the features that can be adjusted to suit the requirements of the user (formatted)
3. Templates: Templates are master documents stored on the computer and have a pre-defined layout. They often include such things as Headers and Footers, address information and frames into which text may be typed. An example is letter headed notepaper
4. Style sheets: Style sheets are master documents stored on the computer and have a pre-defined style. This may include indents, tab- settings and heading/ sub-heading styles. An example is a scientific report made up of different sections, indents and bullet-pointed lists - a style sheet would save considerable time in setting up each page and would ensure a look of continuity throughout the document
5. Importing: DTP packages allow illustrations (photographs, clip-art, graphics etc) to be embedded directly into the text. Other imports include graphs and charts from spreadsheets/ databases, hyperlinks to on-line resources etc
6. Exporting: WP/ DTP packages can export their work directly to printers (colour laser for quality) or as PostScript files to a Printing Company. This company would then use a special machine to convert the postscript file to film, which can then be used to make plates for professional offset colour printing
7. Mail-Merge: With a mail-merge, data from an external database (e.g.: names and addresses of customers) is inserted automatically (merged) at appropriate places into a master document (template) and printed out to create a series of 'personalised' documents

Advantages:

1. Ability to draft, redraft and reprint documents with minimum retyping
2. Presentation of work is greatly enhanced by addition of formats and imported graphics etc and use of style sheets and templates greatly reduces time taken to produce large and/or complex documents – as do features such as automatic page-numbering, headers and footers
3. Ability to send files as attachments in emails and/or to transfer files in formats which enable them to be used directly by professional/ industrial printing processes
4. Ability to view documents on-line and make use of interactive features such as hyperlinks
5. Ability to automatically send a similar letter to many people simultaneously (mail-merge).

Disadvantages:

1. Initial expense of computer and software, particularly at top-end of professional usage
2. An element of training may be required to make best use of software
3. Graphical images/ use of coloured backgrounds etc may be expensive in terms of hardware (file storage) and printing consumables

Examples:

Letters, posters, leaflets, fliers, certificates, booklets, pamphlets, scientific papers, magazines, newspapers, text-books, banners, legal documents, training-manuals, product-labels etc

Questions

1. Describe the difference between a Style Sheet and a Template
2. Describe, using examples, how Headers and Footers might be used to make a multi-page document look more professional
3. DTP software is often described as 'Frame-based'. Discuss what this means,

Keywords

WP/ DTP WYSIWYG Frames Style sheet Template Embedded Indents Postscript files Mail-Merge Header and Footer Automated Page Numbering

**Spreadsheets**

Bullets

- Spreadsheets utilise formulae (formulas), functions, built-in variables and logic functions to perform data analysis
- Results of analysis can be output in graphical form, which is easier to comprehend than numerical data

- Spreadsheets are used for Financial Modelling, WHAT IF Modelling and Object Modelling
- Examples of models include Weather Forecasting, Flight Simulators and CAD
- Spreadsheet models are only as good as the data put into them and can never be a 100% representation of a real-life situation. This is an example of GIGO (Garbage In Garbage Out)
- 

### Text

#### Definition:

Spreadsheets are a type of generic software used to process and display data. They are particularly useful for data-modelling and data-analysis.

#### Main functions:

1. Can perform wide range of calculations on numerical data using:

- FORMULAS, for example:  $(=B3*C3/D3)$
- Built-in FUNCTIONS (standard routines) to create complex formulas, for example:  $(=VLOOKUP(B3,B3:B25,0))$
- VARIABLES – cell references which hold key data used in formulae
- LOGIC FUNCTIONS such as the IF statement, for example:  $(=IF(B3>C3,"YES","NO"))$

2. Can generate GRAPHS and CHARTS

3. Can handle TEXT

#### Advantages:

1. Spreadsheets are part of standard business software, so most people are able to use them without specialist training
2. Data are arranged logically in rows and columns
3. It is easy to replicate formulae (copy down the columns)
4. Graphs and Charts are easier to interpret than numerical data
5. Graphs and Charts change automatically as variables are changed
6. Can be used for FINANCIAL MODELLING, for example a shop could predict potential profit using previous sales data.
7. Can be used for 'WHAT IF' analysis – changing the variables to view the effect on output
8. Can be used for OBJECT MODELLING, for example a virtual reproduction of a proposed road-bridge. Variables could be changed to see how the model (the bridge) would respond to extreme weather conditions. Results of this modelling could be used to change the design – obviously better to do this before building the real bridge. A flight simulator is another example of object modelling, the variables are changed as the trainee pilot 'flies' the model. Computer-Aided-Design (CAD) is another good example of object modelling.
9. Models can be speeded up or slowed down to see effects that would be difficult to monitor in real-life.

#### Disadvantages:

1. The initial expense of software, hardware and training may be high (spreadsheet models such as those used in weather forecasting require massive computing resources, for example)
2. The usefulness of a model depends very much upon the accuracy of the data that is fed into it (GIGO)
3. The data fed into a model can never be a complete representation of a real life situation

#### Examples:

Financial models, Object models (flight simulators, weather forecasters, CAD, engineering analysis)

### Questions

1. Explain the difference between a variable and a function in a spreadsheet
2. Explain, using an example, why "What-If" analysis is a useful feature of spreadsheets.
3. An engineer designing a new type of car engine builds a spreadsheet model first. Explain the advantages of doing this.

### Keywords

Formulae (Formulas) Functions, built-in Variables Logic Functions Financial Modelling WHAT IF Modelling Object Modelling CAD GIGO

## **Presentation Software**

### Bullets

- Exciting, professional-looking multimedia slide-shows for audiences.
- Wide variety of imported objects possible, including video and sound.
- Easily stored and edited on computer for re-use.
- Control over slide-show includes timing of slide transitions and looping.
- Format of individual slides or whole show using format template made easy.
- Animated transitions make presentations interesting.
- May be memory-intensive, complicated to set up and not very mobile.
- Initially high cost of equipment including computer projector.
- Susceptible to system failure or security breach.
- 

### Text

Presentation software allows the user to create multi-media slide-show presentations that can be shown to audiences. These presentations may include graphics, animations and even sound and video clips, and the finished file can be stored on computer, edited and shown again whenever required. (Years ago, this sort of presentation would have required photographic slides or overhead transparencies and a projector, possibly with a tape-recorder to provide the sound track). Presentation software is used by anyone who needs to give information to an audience – teachers, lecturers, business people, visiting speakers etc.

Key features include:

**FORMATTING** (changing the appearance of individual slides – backgrounds, borders, bullets, etc) and use of formatted templates (providing a colour-coordinated outline for the whole slide show)

**IMPORTING OBJECTS** - may include graphs from spreadsheets, images from clip-art libraries, tables from word-processed documents, video clips and sound files etc. Objects which are 'linked' to the presentation (as opposed to being 'embedded') update automatically.

**CREATING A SHOW** - the presenter can control the pace of the slide show by using mouse clicks or key strokes to advance to the next slide. Alternatively, presentations can be made to run automatically, with transitions between slides set to a timer or set to run in a continuous loop.

**ANIMATED TRANSITIONS** - text can be made to appear in a number of different ways ('flying in' from the side, emerging in a 'chequerboard' pattern, or spinning in from the centre, etc) making the presentation more interesting for the audience. Similar effects can be made to the way in which the slides change e.g. one slide 'dissolving' into the next.

Advantages:

Superior quality of presentation compared to using photographic slides etc.

Can include a wide range of multimedia resources, making presentations exciting.

Finished document can be stored, easily edited and reused again and again without loss of quality (unlike photographic slides)

User has a lot of control over the final appearance of slide show.

Can run automatically and continuously in 'loop' mode for exhibitions etc.

Disadvantages:

Multimedia resources can take up a lot of memory

A computer projector is required to show the presentation effectively, and these are expensive.

The whole system (computer, projector, projector screen and cabling etc) can be complicated to set up and therefore not very portable if it has to be taken elsewhere.

A system crash or security breach could result in loss or corruption of the file.

## Questions

1. Describe FOUR different ways in which presentations can be made interesting for their audiences. 2. "You can have too much of a good thing!" - discuss this statement in relation to the features offered by presentation software packages. 3. To what extent should the needs of the intended audience be taken into account when designing slides for a presentation?

## Keywords

audience formats/template multimedia imported object - embedded imported object - linked animated transitions slide transitions slide advance - automatic/ timed looping

## **Databases**

### Bullets

- Flat file database - one table
- Relational Database - more than one table
- Easy to edit records
- Data Integrity
- Data Redundancy
- Greater Efficiency
- Data Flexibility
- 

### Text

#### Main functions

A database stores organised data. Databases can be small or huge but most have the same characteristics.

Data is organised in tables where each row is a record and each column is a field

- Users can add, edit or delete records
- Users can create queries to search the database
- Users can output the results on paper or on-screen.

There are two main types of databases, a flat file database and a relational database. A flat file database contains one table and one key field.

A relational database consists of more than one table that are linked from one to another. Every table in a relational database has a key field (one field that is unique to each record). Both have their advantages and disadvantages.

#### ADVANTAGES of Relational over Flat File

Data Integrity - You only need to change the data in one of the tables, it should then update itself

Data Redundancy - By having a relational database it ensures that no attributes are repeated

Data Consistency - There is no chance of the same attribute being stored in a different format in a different file

Data Flexibility - When dealing with queries, it gets much easier creating deeper queries with a relational database

Greater Efficiency - As you only have to input the data only once into a relational database it saves time and human resources

#### DISADVANTAGES

Complex - Relational Databases can be very complex and without the necessary training can be very hard to break down

Expensive - Relational Databases are mostly commercial and require the user to buy that piece of software or licenses for more than one machine

#### EXAMPLES OF USE

School - Keeps a database of staff addresses, pupil details, timetables, examinations, attendance

Police - Criminal Records

DVLA - Database of current cars on the road and driving licenses  
Hospital - Keeps information on patients, doctors, treatments, drugs used

### Questions

1. Suggest four fields that would be seen in a database about school pupils. 2. Give 4 advantages to using a computerised database over a paper based database 3. Study this table:- STUDENT(Student\_Name,Address 1,Address 2,Age,Sex) - a) Suggest why having "Age" as a field is a bad idea? What could be used instead? b) What are the problems currently faced with a database of this kind? Give a reasonable answer on how to solve this problem. 4. Identify three different data types that might be used in a Swimming Club database and, in each case, give an example of the type of data it might be used for.

### Keywords

Relational Database Flat File Database Key field Data Types Data Formats

### **Web-authoring**

#### Bullets

- Frames - The use of multiple, independent sections to create a single Web page
- Hyperlinks - text link to other webpages or files
- Hotspot - picture / graphic link to webpages or files
- Bookmark - internal 'link'
- HTML - Hyper Text Markup Language is used for creating web pages
- Animation - A collection of static images joined together and shown consecutively so that they appear to move

### Text

Software which helps people to create webpages is known as 'web authoring software' and includes many features to make the process easier. Most importantly, it is not necessary for the user to understand HTML (Hypertext Markup Language) which is the programming language used to create webpages. Many web authoring packages use 'frames', which enable the user to control the layout of different sections, and include libraries of borders, backgrounds, clip-art, graphics and animations etc to enhance the appearance and functionality of the site. Hyperlinks, which usually appear as lines of text, are used to jump to other pages within the website or to other websites, and other types of hyperlink - known as 'hotspots' - are embedded within pictures or graphics, 'Bookmarks' are also used as an easy way to find your way back to a website – just like a bookmark helps you to keep your place in a book you are reading.

### Questions

1. What is the difference between a hyperlink and a hotspot? 2. Why would someone use a hotspot instead of using a hyperlink? 3. What is meant by 'authoring' software?

### Keywords

Bookmarks Hyperlinks HTML Hotspots Frames

### **What is a network?**

#### Bullets

- A group of workstations linked together using communication links
- Networks share peripheral devices
- Each workstation has a network card
- Stand-alone computer - not connected to a network
- Stand-alone computer - restricted to data stored on locally and peripherals that are directly connected

### Text

Networks are groups of computers or terminals such as workstations, linked together by network cabling or by wireless links. Each workstation has a network card into which the cabling is connected. A computer that is not part of a network is called a stand-alone computer. Stand-alone computers can only access data files stored on that computer. They will need their own printer and other peripherals such as a scanner.

### Questions

1. Why does each workstation need a network card? 2. What are the benefits of a network in an office? 3. What are the benefits of a stand-alone computer?

#### Keywords

network wireless network card stand-alone

#### **Networks - Advantages**

##### Bullets

- Share peripheral devices
- Store and share datafiles
- Communication between PCs on a network
- Access to the network is controlled by usernames and passwords
- Control over security and backups

##### Text

Peripheral devices - such as printers - can be shared, thus saving money.

Datafiles can be stored on a central computer so that all workstations can access the same datafiles.

It is possible to communicate with other work stations.

Access to the network is controlled. Different users can have different access rights.

Security and backups are controlled centrally on the file server.

##### Questions

1. List three advantages of networks 2. What are the advantages of a computer connected to a network compared to a standalone computer?

#### Keywords

access communication different user rights security backups

#### **Networks - Disadvantages**

##### Bullets

- If server fails, network fails
- Security not as tight as on standalone
- Network will be slow if there is a lot of traffic on the network
- Greater risks from viruses
- Networks can be expensive to install

##### Text

If the network server fails the whole network fails, which leads to a breakdown in productivity.

Security may not be as secure as on a standalone machine. Unauthorised internal and external access to data can be disruptive.

If there is a lot of network traffic, access to data may be slow - again this can have a negative effect on productivity

A virus could spread quickly through the network

Networks are expensive to install

##### Questions

1. Why is it not possible to use the network when the server is down? 2. Why does a network have to be made safe from a virus attack?

#### Keywords

network server security virus

#### **Local Area Network (LAN)**

##### Bullets

- LAN - confined to one establishment.
- Uses cable and/or wireless communication

- Network is usually controlled by a Network Administrator.

#### Text

A local area network is usually confined to an establishment or a small geographic area. Communication can be in the form of fibre optic, copper cabling (Ethernet) and/or wireless devices.

The network (including users, data files, software, hardware and backup procedures) will usually be managed on site by a dedicated team of network administrators.

#### Questions

1. Why do many businesses decide to use a Local Area Network? 2 How does a LAN differ from a WAN?

#### Keywords

LAN wireless network administrator

### **Wide Area Network (WAN)**

#### Bullets

- WANs connect LANs and computers over a wide geographical area
- Developments in the internet have contributed to increased use of WANs
- WAN's can be made public - the internet, or private - owned and managed by an organisation

#### Text

Computers in a Wide Area Network (WAN) are connected over a wide geographical area, even from one country to the other. WANs allow LANs to be connected together. They are connected using special cables or other telecommunication methods such as public phone lines or special satellites. WANs can be public - the internet, or private - a secure network owned and managed by an organisation. A WAN is used to connect supermarkets across the country with their central warehouse. Data regarding the sale of each item is sent daily to the warehouse using satellites. This enables the warehouse to see what needs to be loaded onto the lorry to fill the shelves for the next day. There has been a growth in WANs over the last few years because of the development of the internet. This growth in the internet has helped to develop e-commerce, and more and more people and companies use e-mail. The falling cost of the internet and increase in speed of transmission of data is also an important contributing factor.

#### Questions

1. Who would use a WAN? 2. What are the benefits to a company of using WANs? 3. Are there any disadvantages to using WANs? 4. Why is speed of transmission important?

#### Keywords

wide geographical area telecommunication e-commerce

### **Wireless Networks**

#### Bullets

- Wireless networks use radio waves for data transmission
- No cabling required
- Enable businesses and organisations to have mobile access to data, e.g. deliveries can be tracked through the use of barcode and mobile hand held devices

#### Text

#### Radio Transmission

Devices have radio transmission facilities and radio receivers. These radio receivers constantly scan the airways for incoming signals. When it detects the signal it recognises, it captures it and converts it into digital form. The digital signal can be transmitted to the CPU either by cable, or wireless routers can be used.

People now need to be mobile and still access their networks, e-mail accounts etc. e.g. doctors at the scene of an accident accessing patient records.

Wireless networks may be used as part of a LAN e.g. a mobile bar code reader in a warehouse

Part of a WAN or Virtual Private Network e.g. a delivery driver using a hand-held device to confirm deliveries with a central database.

Wireless systems transmit using radio waves or infra-red light.

Infra-red refers to light waves of a lower frequency than human eyes can receive and interpret. Infra-red is used in most television remote control systems, and with a standard called IrDA (Infra-red Data Association) it's used to connect some computers with peripheral devices. For most of these computer and entertainment purposes, infra-red is used in a digital mode - the signal is pulsed on and off very quickly to send data from one point to another.

### Questions

1. Give advantages of Wireless networks 2. Are there any disadvantages of wireless networks? 3. Who would use wireless networks? 4. Why is the development of wireless networks important?

### Keywords

Virtual Private Network (VPN) infra-red

### **Networks Types - Star**

#### Bullets

- Each PC is connected to the server
- Computers can easily be added or removed
- PC's either connected by wire or wireless
- Effective in situations where computers are distributed across one site
- Backups can be made centrally
- Security is good due to controlled access rights
- If switch or server breaks down the whole network fails

#### Text

Each member of the network is connected directly to a central controlling computer (file server).

A star network is particularly effective in situations where computers are distributed across one site, e.g. in a school, college or hospital, computers can easily be added or removed from the network without disturbing any of the others. Computers may be connected to the star network by cable or wireless.

#### Advantages

If the connection breaks down, only the one computer will fail to connect to the network, all others should continue to work normally.

Easier to detect faults.

No disruptions when adding or removing workstations.

Better security of data, access rights

Backups can be performed centrally

#### Disadvantages

Expensive hardware and setup costs.

If the hub/switch is faulty or breaks down the whole system (or the linked workstations/nodes) are out of action.

### Questions

1 Describe a Star Network 2 Where would a Star network be used? 3 What are the advantages of a Star Network? 4 What are the disadvantages of a Star Network?

### Keywords

central controlling computer (file server) wireless connection

### **Network types - Bus (Line or Ethernet)**

#### Bullets

- All PCs are connected to a central cable
- If cable breaks down the whole network will not work
- Cheap and relatively easy to set up

- Network speed slows down with high traffic

#### Text

In a Bus Network all the workstations/nodes are connected to a central cable. This cable carries data backwards and forwards until it reaches its correct destination.

#### Advantages

If the connection between the bus and a computer breaks down, the remainder of the network will be unaffected.

Not expensive and relatively easy to setup.

Reliable.

#### Disadvantages

A disadvantage of this type of network is that the distance between the network's computers is limited by the length of the bus.

If the bus is too long then signals will lose their strength before they reach the end of the bus.

Liable to high network traffic.

A fault in the bus cable will lead to the network being brought down.

#### Questions

1 What are the benefits of a Bus network? 2 What are the disadvantages of a Bus network? 3 Why is a Bus network relatively easy to set up? 4 Why does cable failure affect the whole network?

#### Keywords

bus workstations nodes high network traffic

### **Network types - Ring**

#### Bullets

- Each computer is connected to the next in a loop
- A token travels around the circle
- Good transmission speeds can be obtained
- Cheap to install
- Suitable for small networks

#### Text

Each computer in the network is connected to the next in a closed loop.

A token travels around the circle. To send a message, a computer catches the token, attaches a message to it, and then lets it continue to travel around the network until it reaches its destination.

#### Advantages

With suitable cabling and the fact that data travels in the same direction - good transmission speeds can be obtained.

It is a particularly cheap method to install since the amount of cabling needed is smaller and a server isn't needed.

All workstations/nodes have equal status.

#### Disadvantages

A disadvantage of ring networks is that a break in the main communication link will prevent the network from working.

If a workstation malfunctions it may have a negative effect on the whole network.

Only suitable for small networks.

#### Questions

1. Explain how a Ring network works 2. Describe the benefits of a Ring network 3. What is a token? 4. What happens if one computer in the ring fails? 5. Where would a token ring be used?

#### Keywords

closed loop token

### **Network types - Client Server**

#### Bullets

- Central computer which can be accessed by all workstations
- Data files and software are stored on the file server
- Access rights enable high security

#### Text

This type of LAN has a central computer which can be accessed by all workstations. Data files are stored on the file server and backup is easy to perform. Software is installed once - centrally and made available to each workstation. Security is high with the use of usernames and passwords. Access rights can control 'who sees what' on the network. In order to provide high speed network access, servers need to have fast processing speeds, large memory and a large hard drive. These can be expensive and in larger networks, complicated to install.

#### Questions

1. Explain what is a client server network? 2. What is meant by access rights?

#### Keywords

access rights

### **Network types - Peer to peer**

#### Bullets

- Does not have a fileserver
- All work stations have equal status
- Separate backups must be done for each individual station.
- Inexpensive and easy to set up
- Not suitable for medium/large networks

#### Text

This type of LAN has no file server and all workstations are equal. Data files are stored on each workstation although users can gain access (depending on privileges) to data stored on other machines. Separate backups must be done for each individual station.

Software must be installed on individual workstations which is time consuming.

A peer to peer network is inexpensive and easy to set up but is typically used in small offices where four or five workstations need to share data.

#### Questions

1. Why must a separate backup be made for each workstation? 2. Why would a peer-to-peer network not be suitable for a large office? 3. Why must software must be installed on individual workstations?

#### Keywords

peer-to-peer fileserver

### **Factors to consider when choosing a network**

#### Bullets

- Amount of money available determines type of network
- Fibre-optic and wireless networks have different benefits
- Storage and processing needs have to be considered
- Fit in with the company's existing systems
- Security issues needed to prevent hacking, viruses and downloading illicit material

#### Text

Cost of the network. The amount of money available will determine the type of network purchased, e.g. fibre optic cable is faster but is also more expensive. Wireless systems are flexible but need more maintenance.

The needs of the company can range from a small LAN to a global WAN.

Consideration must also be made of the amount of data processing required.

Will the users need large data storage? Where will they operate the network? e.g. at home, in the office or remote access from different locations.

Will the new network fit in with the company's existing systems? It must support any peripherals already in use e.g. bar code readers, printers.

Will the performance in terms of reliability, user friendliness and speed of processing be adequate? Different parts of the organisation may have different performance requirements. An e-commerce system must be a secure realtime system compared to the company's own payroll system.

Security is an issue - it is important to prevent hacking, the spreading of viruses and downloading of illicit material.

### Questions

1. Describe the main points to consider when choosing a new network? 2. How would you keep a network safe? 3. What is meant by remote access? 4. Compare and contrast fibre-optic and wireless networks.

### Keywords

fibre optic wireless reliability user friendly security

### **Networks - Security: Physical**

#### Bullets

- Physical safety - lock computers to desks, locking doors
- Restricting access to computer rooms - finger or retina scans
- Keep backup copies in other sites
- Prevent overwriting of discs with write-protect tab

### Text

Safeguarding against physical theft or destruction of computer equipment is important. This can be done by locking computers to desks; keeping doors and windows locked, and by using fireproof doors and smoke alarms, and restricting access to rooms with smart cards, hand or voice prints, or retina scans.

The deliberate or accidental destruction of files can be safeguarded against by making backup copies and keeping copies in secure locations on and off sites. Have systems that automatically backs up the data and follow the grandfather-father-son security systems in batch systems. Data can be prevented from being overwritten by having a write-protect notch on the disc and by making the discs read only.

### Questions

1. What is meant by grandfather-father-son system? 2. How would you safeguard against physical theft of data. 3. What sort of systems could automatically backup data.

### Keywords

physical safety locking computers fireproof doors smoke alarms smart cards hand or voice prints retina scans

### **Networks - Security: Malicious Damage**

#### Bullets

- Different users having different access rights
- Passwords must be at least 8 characters long and changed often
- Use virus scanning software to prevent virus spread
- Do not download programs from the Internet
- Never use illegal software

### Text

Hacking into a network can be reduced by assigning different access rights to different users, network managers having access to all the network, but limiting other users to certain areas and only being able to run some applications and software. Passwords must be at least 8 characters long and should be changed often.

Viruses are programs introduced into computer systems which destroy or alter files by rewriting over data or by

copying themselves over and over again until the computer system is full and cannot continue. These can be prevented by using virus scanning software, by not downloading programs from the Internet, by write-protecting media so that data cannot be written onto them. Always use legal copies of software.

#### Questions

1. Why must passwords be at least 8 characters long and be changed often? 2. What is a virus? 3. Give examples of damage done by a virus. 4. What is hacking? 5. What is meant by access rights? 6. What is meant by write-protect?

#### Keywords

hacking passwords access rights virus scanning software write-protect

#### **Networks - Security: Integrity**

##### Bullets

- Use mirror drives as backup
- Use grandfather-father-son system of backups
- Use UPSs to protect against power failure
- Have validation and verification procedures in place
- Train all employees

##### Text

Hard drive failure can be overcome by purchasing backup systems including mirror drives (RAID - Redundant Array of Independent Disks). Using the grandfather-father-son system of backups, the data can be restored from the mirror drives or the backup. Power failure can be prevented by purchasing an Uninterruptible Power Supply (UPS) or using alternative power supplies.

Accidental damage by employees can be reduced by carrying out thorough training for new employees. All employees should be screened for suitability for the work.

#### Questions

1. What are UPSs and when would they be used? 2. Give an example of a transmission error? 3. What is double keying? 4. What sort of accidental damage could an employee cause? 5. What are mirror drives?

#### Keywords

grandfather-father-son RAID transmission errors parity bits

#### **Internet, Intranet, Extranet**

##### Bullets

- The Internet is an extremely large collection of networks linked together. It is a network of networks.
- An intranet is set up within the LAN of a school or company, it can only be accessed from the LAN.
- An extranet is when a school or a company allows access from outside to its intranet. Access would be controlled through a firewall.

##### Text

The Internet is an extremely large collection of networks linked together. It is a network of networks. To connect to the Internet an ISP (Internet Service Provider) is needed, e.g. Freeserve, AOL. The user can use search engines to search the World Wide Web for any subject. The pages have links to other pages. It is possible to download software, access bulletin boards or newsgroups.

##### Intranets

An intranet is set up within the LAN of a school or company. Web pages can be stored on the central file server and accessed from anywhere on the network and e-mail can be sent internally within the LAN.

An extranet is when a school or company allows access from outside to its intranet. Access would be controlled through a firewall.

### Questions

1. Describe the difference between an intranet, extranet, and Internet. 2. What are the dangers for a company setting up an extranet? 3. What are the benefits for a school of setting up an intranet?

### Keywords

Internet intranet extranet firewall access

### **File Transfer Protocol (FTP)**

#### Bullets

- File Transfer Protocol (FTP)
- Set of rules that enables files to be transferred from one computer to another over the Internet.
- Most commonly used to upload web pages on to a web server.

### Text

The Internet uses internationally agreed standards so that it can be accessed from a variety of hardware platforms (nowadays even mobile phones or digital TVs can access the net). The standards, or protocols used include FTP (File Transfer Protocol), which is a set of rules that takes care of the details of how files are transferred across the Internet from one computer to another, usually involving uploading to or downloading from a server.

Every computer on the Internet must have a name by which it can be recognised, and every name must be different. This 'unique identifier' is called its Internet Protocol address or IP, and consists of four numbers separated by periods (full-stops). (For example, the IP address for the BBC website is 132.185.132.21 but because we would find the IP difficult to remember, we use its URL instead – i.e. www.bbc.co.uk).

TCP/IP (Transport Control Protocol/ Internet Protocol) refers to several different protocols that computers use to transfer data across the Internet, but basically the route the data takes depends on the IP address of the destination. FTP uses TCP/IP to enable data transfer.

### Questions

1. What is the main use of FTP? 2 Why is this protocol important?

### Keywords

File Transfer Protocol (FTP) upload download

### **Types of HCI**

#### Bullets

- For Command Line Interfaces, user must learn coded language and instructions to computer are then typed in - efficient once you know the commands, and takes up fewer computer resources
- GUI systems use WIMP environments which follow familiar patterns, are easy to use and do not require learning of a computer language. GUIs cost more to develop and take up lot of computer resources.

### Text

#### COMMAND LINE INTERFACES (e.g. MS DOS)

User types in coded commands for system operations (make new directory, delete files, copy files from directory to floppy disk etc) and computer performs tasks when [ENTER] pressed

User must learn coded commands, which makes this type of HCI more suited to the technically-minded / computer professional

Once learnt, provides effective method of communicating with the computer

Uses less memory/ processing resources than graphical user interface

#### GRAPHICAL USER INTERFACE (e.g. MS WINDOWS) - GUI pronounced 'gooey'

Windows – overlapping frames viewed singly or in combination on screen

Icons – pictures symbolising actions provide shortcuts to computer operations

Menus – feature pop-up screens, pull-down lists from menu bars

Pointers – move around screen, locate where on the screen user is working, and select which commands are to used (e.g. mouse/ mouse buttons)

## ADVANTAGES OF A GRAPHICAL USER INTERFACE

No need to learn a specific computer language (like MS DOS)

Use of icons / graphical images provides short-cuts and an easy way for beginners to get into the software

Mouse provides an 'intuitive' method of communicating instructions to the computer whereby movement of the hand is directly related to movement of the pointer on screen

Menus provide less ambiguous instructions – offer straight choices

## DISADVANTAGES OF A GRAPHICAL USER INTERFACE

Demand more memory and processing resources (may need to upgrade computer in order to use the GUI)

Take up more space on backing stores (Hard Disk Drives) and servers

Are usually more expensive to buy because of the number of people and time spent in development

## Questions

1. Discuss why a Graphical User Interface (GUI) might be more suitable than a Command Line Interface for someone who is new to computing 2. State TWO reasons why an experienced computer professional might prefer to use a Command Line Interface rather than a Graphical User Interface

## Keywords

Command Line Interface Graphical User Interface GUI Windows Icons Menus Pointers

## **Features of a good HCI**

### Bullets

- A sophisticated GUI will offer many features
- Makes it easier for both new and experienced users to work effectively, to find help when needed, and to customise their desktops to suit personal preferences
- Customisation includes changes to icons, toolbars, templates, on-screen fonts and colour schemes

### Text

ON-LINE HELP FOR THE USER - includes signposts, searchable index of help topics, contextual help, step-by-step guidelines, wizards to perform set tasks, pop-up screens and tips etc. It should also be accessible (in a language understood by the general user) and sensibly organised.

CONSISTENCY - the HCI should be similar to others, making it easier to learn, and include commonly used main items (such as COPY/ PASTE). Colour schemes and layout should be consistent throughout.

LAYOUT - the HCI should be well organised and easy to follow. Colour schemes should be easy on the eye, with no clutter and have a good balance between white space and information.

DIFFERENTIATION - the HCI should cater for both novices (point and click, icons, drop-down menus etc) and advanced users (keyboard short cuts)

CLARITY - instructions, error messages etc should be clear and should take into account the level of ability of the user, thus reducing anxiety when things go wrong.

STRUCTURE - users should be able to grasp the geography of the site (site map) and be led logically through the application. There should be a clear route to get back home.

MULTITASKING - the ability to run several applications at the same time.

CUSTOMISATION - ability for user to change colours/ fonts (screen configuration), customise toolbars and produce personal templates etc

toolbars can be set vertically or horizontally

icons can be removed to reduce clutter

additional icons can be created to run own macros (e.g. letterhead for mail-merge)

items can be removed from menus to reduce clutter/ focus on most commonly used operations

screen fonts can be set to personal preferences and/or to ones better suited to users with visual impairments

templates and outline documents which contain individual details and/or preferences can be produced (e.g. mail-merge template with company address and logo)

screen views can be altered to make more or less of the page visible, in either portrait or landscape

screen colours can be changed from de facto grey/ blue/ black/ white to suit user preferences

### Questions

1. Discuss the different ways in which a Graphical User Interface can be customised to produce a personalised computing environment for the user 2. Explain what is meant by 'contextual help' 3. Explain what is meant by 'searchable help index' 4. Most Graphical User Interfaces employ 'wizards'. With reference to a named example, explain how wizards can make life easier for a computer user.

### Keywords

on-line help searchable help index contextual help consistency layout differentiation clarity structure multitasking customisation template

### **Considerations when designing**

#### Bullets

- An HCI consists of input/ output devices together with the software that creates a particular screen configuration for interaction
- Keyboard/Mouse/Screen is most common HCI but others include voice activation systems, biometrics and touch-screens
- Factors taken into account when designing a HCI include physical factors (its purpose, type/disabilities of users, environment, Health & Safety issues)and psychological factors (technophobia, frustration) etc

### Text

An HCI consists of input and output devices which tell the computer what to do/ deliver responses from the computer to the user, and software which creates a particular screen configuration for the user to interact with.

#### WAYS OF INTERACTING WITH THE HCI

The most common HCI consists of keyboard, mouse and computer screen PLUS associated software, but other ways include:

Voice activated devices (microphone)

Graphical devices (light pens, digitisers, graphics tablets, drawing devices)

Game playing devices (joysticks, feedback steering wheels)

Pointing devices (mouse, tracker-ball, motion sensor devices which allow 3D positioning)

Touch-screen

Biometric systems (iris recognition, fingerprint recognition for security systems)

#### PSYCHOLOGICAL FACTORS

A good HCI will:

reduce the fears of users (technophobia) by offering an easy way of rectifying erroneous actions (e.g. edit > undo)

allow personalisation of common elements (arrange icons, change colour schemes) to make users feel less at the mercy of the computer

Minimise frustration by providing an effective way to issue commands and receive information from the computer

Avoid information overload by having uncluttered screens, concise message boxes and menus which are not too extensive

#### PHYSICAL FACTORS

A good HCI will:

Be appropriate for its purpose (a flight simulator will be similar in appearance to an aeroplane cockpit) and its interactions will closely resemble those done by humans in the real world.

Take into account the type of user (an HCI for a child's program will use bright colours, cartoon figures)

Take into account the environment in which it will be used (a factory CAD machine will be robust)

Be aware of Health and Safety issues (ergonomic keyboards)

Take into account disabilities of intended users (voice activated for people with disabilities, touch-screen for interactive museum system)

### Questions

1. Discuss physical factors that should be taken into account when designing a Human Computer Interface 2. The word

'technophobe' is sometimes applied to people who are nervous of using computers. Describe how a good HCI can help such people overcome their initial fears.

#### Keywords

HCI voice activated graphical devices pointing devices touch-screen biometric systems technophobia

#### **Health and Safety**

##### Bullets

- Repetitive Strain Injury
- Eyestrain
- Stress
- Back Strain
- For every health issue there is a prevention
- Most can be prevented by good lighting or good posture
- Important to take breaks from working

##### Text

There are many health and safety issues associated with the use of ICT. With so many people working with computers everyday companies urge their employees to prevent illnesses. These are the most important issues:-

REPETITIVE STRAIN INJURY refers to a range of conditions affecting the neck, shoulders, hands and arms. RSI is caused mainly when the user repeats similar movements such as clicking the mouse buttons or typing. A simple prevention to RSI would be using wrist guards or simply make sure the keyboard is at the correct height.

EYESTRAIN is caused when people stare at bright screens all day long, causing the eyes to re-focus constantly. Eyestrain can cause discomfort and make employees less efficient. A simple way of preventing eyestrain would be working in a well lit office and taking regular breaks.

STRESS can be caused to some employees as working in a computer based environment can be stressful. Computers have raised expectations about what is possible which has led to employees receiving more work.

DEPENDANCY - this happens when many workers can work from many different locations at any time. Some people can get "addicted" to work and find it difficult to switch off.

BACK STRAIN - can occur when workers have bad postures when sitting by their computers. Backstrain can be prevented by taking frequent breaks to move around, having comfortable chairs and maintaining a good posture.

##### Questions

1. State two health issues that could arise from constantly using computer systems and give a way that they could be prevented. 2. Discuss the health issues raised by the increased use of ICT systems in the home. 3. How can companies minimise the risk of losing employees down to health and safety within the workplace.

##### Keywords

Repetitive Strain Injury (RSI) Prevention

#### **Code of Conduct**

##### Bullets

- Use a password system
- Strict levels of access
- Protect the hardware from physical theft
- Any data that is transferred can be encrypted
- Use firewalls
- Virus protection software
- Train staff about security issues
- Have a backup procedure and a disaster recovery plan
- 

##### Text

Code of conduct when using a network and the Internet

- Staff should follow strict procedures when using an information system. They should use a password system, not disclose their password to anyone, log off properly, not download from unsafe websites or use illegal software
- Systems should have strict levels of access. Employees should be able to access only those areas of the system that they have been cleared to work on.
- They can protect the hardware from physical theft or access by using security guards, securing areas with limited access by the use of locks, alarms, security cameras and biometric devices.
- Any data that is transferred within a company and outside the company can be encrypted so that it is not easily readable.
- The organisation can use firewalls. A firewall is a combination of hardware and software designed to check the legitimacy of incoming messages and requests for services.
- Use virus protection software to detect and eradicate viruses.
- Staff should be trained to be aware of security issues and to understand the importance of being security conscious.
- The most effective security measure is a carefully executed backup procedure which will allow recovery from loss of data or system failure.

### Questions

1. List 5 things a company could do to help protect its computer system. 2. What could be a threat to a system and what action could be taken to reduce that threat?

### Keywords

password limit access protect hardware encryption firewalls virus protection train staff backup procedure

### **Computer Crime**

#### Bullets

- Computer crime is any illegal use of an ICT system
- Malpractice is professional misconduct
- 

#### Text

Computer crime is any illegal use of an ICT system. Malpractice is professional misconduct which means acting in an unprofessional way that leads to unauthorised loss of data e.g.

- Introducing viruses (malpractice)
- Hacking and cracking (crime)
- Publishing inaccurate, libellous or offensive material (malpractice or crime)
- Using the Internet to recruit for illegal groups (malpractice or crime)
- Hiding your identity (crime)
- Blackmailing and stealing (crime)
- Bogus websites and credit card fraud (crime)
- Money laundering (crime)
- Buying and selling illegal goods (crime)
- Illegal downloads (crime)
- Industrial espionage (crime)
- Sabotage (crime)

### Questions

1. Give 5 examples for computer crime. 2. Define the term 'malpractice', 'hacker' and 'cracker'. 3. List 5 things a company could do to help protect its computer system.

#### Keywords

crime misconduct malpractice

#### **Data Protection Act**

#### Bullets

- DPA became law in 1984
- People were becoming concerned about stored data and how secure and accurate this was
- Revised in 1998 to include manual data and the rights of data subjects were extended
- Eight principles in this Act
- Exemptions from the Act
- Everyone has the right to see data held about them
- 

#### Text

The Data Protection Act (DPA) became law in 1984 as people were becoming concerned about the number of computer based systems that stored data and how secure and accurate this was. This law was revised in 1998 to include manual data and the rights of data subjects have been extended.

There are eight principles in this Act which are:

1. Data must be processed fairly and lawfully e.g. the data subject has given their consent.
2. Data must be obtained for one or more or specified purposes and must not be processed in any other way i.e. the purpose stated on the Public Register is the only purpose for which the data can be used.
3. Data must be adequate, relevant and not excessive in relation to the purpose.
4. Data must be accurate and where necessary up to date.
5. Data must not be kept for longer than is necessary for the registered purpose.
6. Data must be processed in accordance with the rights of the data subject.
7. Appropriate technical and organisational measures must be taken against unauthorised or unlawful processing and against accidental loss of, destruction of, or damage to personal data.
8. Data must not be transferred to a country or territory outside the EU unless the country ensures an adequate level of data protection legislation.

There are exemptions from the Act:

- data processed by an individual for personal, family or household affairs or recreational purposes
- data processed for use in journalism, literature or art (as long as its use is in the public's interest)
- data to be used for research purposes, or to produce statistics (as long as it does not identify anybody in particular)
- data used for accounting purposes as required by law (wages or pension)
- data held in the interests of national security (e.g. information about members of the armed forces, the intelligence services, judges) or for the prevention of crime
- data used for producing mailing lists and containing only names and addresses (but only if the individual does not object)

Everyone has the right to see data held about them except for data that might:

- affect a criminal investigation
- affect the outcome of a court case
- affect a tax assessment
- identify another person

### Questions

1. List five types of data that are exempt from the DPA. 2. Explain what 'subject access' means. 3. Give three problems that arise from storing criminal records.

### Keywords

eight principles exemptions

### **Computer Misuse Act**

#### Bullets

- Introduced in an attempt to decrease computer fraud
- Three levels of offences
- Unauthorised access to computer material
- Unauthorised access with intent to cause further offence
- Unauthorised changing or deleting files
- 

### Text

#### Computer Misuse Act

The Act was introduced in an attempt to decrease computer fraud and to deal with deliberate access or damage to data.

There are three levels of offences.

1. Unauthorised access to computer material e.g. hacking and piracy. That means viewing the data you are not permitted to see or illegally copying programs. Maximum penalty – 6 months imprisonment or £5000 fine, or both.
2. Unauthorised access with intent to cause further offence e.g. fraud and blackmail. That means gaining unauthorised access with the intention of committing a more serious crime. It covers fraud, blackmail and deception. Maximum penalty 5 year imprisonment and a fine.
3. Unauthorised changing or deleting files e.g. planting a virus. This means modifying or deleting the content of any computer with intent to cause damage to programs and / or data (including deliberately introducing a virus). This can get you a fine and up to five years imprisonment.

In order to prosecute someone, it has to be proved that they intended to gain access to data or programs, did not have authorisation to do so or knew and understood that they did not have authorisation.

### Questions

1. Give an example of an offence for levels 1, 2, and 3 of the Computer Misuse Act. 2. What is currently the maximum sentence you could get for deliberately gaining unauthorised access to files if it is proved that you did not intend to commit further crimes. 3. State three problems with the current Computer Misuse Act.

### Keywords

computer fraud unauthorised access

### **The Copyright, Designs and Patents Act**

#### Bullets

- Illegal to copy a file without permission
- Individuals or organisations who break this law risk an unlimited fine.
- Three main areas
- Using software without a proper license
- Software piracy
- Illegally downloading material from the Internet
- 

### Text

This law makes it illegal to copy a file without permission from the owner or copyright holder. Individuals or

organisations who break this law risk an unlimited fine.  
There are three main areas where legislation may be needed:

- using software without a proper license e.g. when you buy software, you have to buy a license also – either a single-user license, multi-user license, network license or a site license.
- software piracy e.g. professional criminals producing hundreds of copies of games and selling them
- illegally downloading material from the Internet e.g. downloading MP3 files from illegal sites to avoid paying for them or copying text or images from the Internet without acknowledging them or receiving the owner's permission to use them.

### Questions

1. Explain three ways in which the law can be broken under the Copyright, Designs and Patents Act. 2. Describe what is meant by a 'software licensing agreement'? 3. Would a company be breaking the agreement by installing software on 5 PCs and 3 laptops if they had a license for 5 multi-users? Why?

### Keywords

illegal permission fine

### **Education**

#### **Computer Assisted Learning**

#### Bullets

CAL - there are several types:

- ☒ Tutorials
- ☒ Drill and practice (repeat over and over again)
- ☒ Simulations
- ☒ Games
- ☒ Tests
- ☒ ☒

#### Text

Computers, particularly multi-media systems can be used for education and training.

(i) Many software packages come with 'Tutorial' sessions, which allow the user to learn by following simple instructions on the computer. They can be used for teaching Maths, ICT etc. Questions might be asked and the session continues only if the user enters the correct answer. Instant feedback from the computer helps students improve their knowledge.

(ii) Integrated Learning Systems (ILS) give students their own specific learning programme which is aimed at their ability. These programs have an interactive component where students are tested with games and quizzes. They are useful in the teaching of a number of students especially those with special needs. A scoring system allows the students to assess their own progress. Often after 3 tries the answer or clues will be given to them. Pictures and sounds are used to enhance the experience.

(iii) Interactive revision programs e.g. BBC GCSE Bytesize. This type of sites allows the pupils to access revision notes, quizzes and message boards outside the classroom environment. Teachers are also available on-line for pupils to e-mail them for answers and advice.

### Questions

1. What are the main advantages of using ICT in teaching and learning? 2. Identify some of the concerns that have been expressed about the use of ICT systems in education. 3. How does the internet provide learning opportunities for school children?

### Keywords

tutorials instant feedback simulations

### **Computer Based Training**

#### Bullets

- Distance learning
- On-line courses
- E-learning
- Chatrooms
- 

#### Text

##### (i) Distance Learning

Students no longer have to be in the same location as the teacher. This can be beneficial for students with disabilities or ones living in remote areas. Videoconferencing can be used for lectures: assignments can be submitted using e-mail and are marked electronically. Students are provided with course booklets and practical work. The tutor may visit every 4 – 6 weeks for face to face consultations. The main benefits of this type of learning are that expertise and staff are shared with other schools and that travelling between venues is minimised.

##### (ii) On-line courses

These can be Intranet based in universities or Internet based. Some university modules are completely computer based with knowledge sections and task sections. The software records how much of the course has been covered and if the full module is not completed, the module is failed. The classic distance learning is the Open University which now has greater on-line components to its courses.

(iii) E – learning sites are now available. Subscribers can even do A levels on-line approved by exam board such as OCR. Schools in England are given E-learning credits which they can use to purchase on-line courses.

(iv) Chat rooms are available for students to discuss courses and problems with tutors. These are closely monitored within the school environment but great care and the usual protocol and precautions must be taken when accessing them from home.

#### Questions

1. What are the main advantages of distance learning? 2. Explain what is involved in videoconferencing and what resources an organisation needs to facilitate it. 3. Identify one advantage and one disadvantage of using videoconferencing as a way of facilitating meetings between members.

#### Keywords

distance learning video conferencing e-learning collaborative work

### **Advantages of using ICT for Teaching and Learning**

#### Bullets

Advantages of using ICT in education:

- Quicker feedback
- Variety of different ways to learn
- Learn at own pace
- Repeat sections they found difficult earlier.
- Reduces costs for the employers
- Students present their work more neatly
- Supports many different formats of teaching
- The Internet is an useful resource of information

#### Text

- Greater interactivity holds a students attention.
- Quicker feedback in on-line tests
- Offers a variety of different ways to learn and a variety of information sources.
- Allows user to learn at own pace and can learn at times suitable for themselves
- Allows user to 'go over' earlier work again in case they did not understand i.e. repeat sections they found difficult earlier
- Computer based training significantly reduces costs for the employers and can be safer if, for example it is a dangerous experiment or process
- Students can use ICT in order to present their work more neatly
- ICT can support many different formats of teaching in which students can be drawn into different subjects
- Sensors, measuring and calculating devices can help students understand mathematical concepts e.g. Science
- Using computers often encourages students to work together collaboratively and so develop some social skills
- The Internet is an useful resource of information for students at all levels

### Questions

1. How is the learner able to learn at his/her own pace? 2. Why can it be less expensive for employers? 3. Give three examples of how ICT is used in schools?

### Keywords

interactivity feedback maintenance social interaction

### **Disadvantages of using ICT for Teaching and Learning**

#### Bullets

Problems using ICT in education:

- Expensive
- Cuts down on social interaction skills
- Cuts down concentration spans
- Reduction in spelling skills because of the use of abbreviations
- Does not provide the personal support
- Over reliance
- Hardware can be unreliable
- Raises security issues

### Text

Apart from general problems associated with using computers there are a few specific ones.

- ICT is expensive and requires a great deal of capital investment which is constantly updated and has to be maintained. Maintenance contracts can run into thousands of pounds which take money away from traditional teaching materials such as books.
- Richer schools will have greater resources so there is an unfair distribution of ICT resources and hence learning opportunities.
- Some educationalists argue that younger students do not have as great an opportunity for group learning and this cuts down on social interaction skills.
- Some educationalists say the change in patterns of learning cuts down concentration spans.
- Text messaging has been blamed for a reduction in spelling skills because of the use of abbreviations.
- Distance learning does not provide the personal support needed by most students as and when they need it. The availability of support, advice and guidance is particularly crucial when a student lacks confidence or cannot interpret the written instruction.
- Over reliance e.g. if there is a power cut you cannot use it.
- Hardware can be unreliable and breakdowns can lead to frustration

- Use of the Internet in classrooms raises security issues such as accessing unsuitable websites

### Questions

1. Why can the use of ICT for Teaching and Learning impact on social interaction? 2. Give three other problems associated with the use of ICT in schools?

### Keywords

social interaction capital investment

### **Software used in schools**

#### Bullets

- Template already set up - time not wasted
- Templates have a consistent style
- Style sheets used to set layout and format
- Databases used to store, search and sort data

### Text

Presentation ('PowerPoint'-type) software

- Pre-prepared Design Templates can have a set layout and graphical image (e.g. a company can have a set page design which all of its employees use)
- Animations and transition effects are movement effects designed to keep the audience's interest and liven up a presentation
- Individual pages can be projected as an automated slide show
- Editing/formatting of work is made easy

### Web Browsing Software

- Web pages can be accessed by using a web browser such as 'Internet Explorer' (type the address of the site into the address box of the web browser. The address is known as an URL - Unique Resource Locator)
- An Internet Protocol address can be entered instead of an URL - this is the numerical identifier that the URL represents in a more user-friendly format
- Most users go to a search engine site (e.g. Google) to type in key words to search for a particular item
- Information in the Web pages can be accessed by Key Word searches, or by clicking on Hyperlinks/ Hypertext or Hotspots to go to other parts of the webpage or website

### Web Authoring Software

- User-friendly software allows individuals with little or no programming experience to create their own websites
- Instead of writing code, users build their site via a graphical user interface, dragging and dropping objects on to a page template
- Help includes wizards (series of dialogue boxes that take a user through a procedure one step at a time)
- Users can import animated graphics, video clips and sound files etc

### Spreadsheet Software

- Automatic recalculations and 'what if' modelling
- Graphs - display complex information in a way it can be easily understood
- Templates - saves time if a company has a 'house style' template which all employees use
- Statistics - analysis tools save time and increase accuracy of data analysis
- Editing, formatting of work is made easy

#### DTP/ Word Processing Software

- Editing
- Formatting a document
- Style sheets
- Importing and exporting data
- Mailmerge

#### Database Software

- Data is organised in tabular structures (each row constitutes one record, each column defines a field)
- Users can sort, edit, amend and delete the data
- Users can interrogate (query) the database to find records which satisfy certain criteria
- Results of queries can be output as reports or graphs

#### Interactive Whiteboards

These can be used instead of a traditional board to display computerised teachers' notes and presentations. It is basically a large projected computer screen which can be controlled by moving and clicking a special pen on the screen

- Special software simplifies difficult concepts and allows pupils to interact with the screen

#### Questions

1. Name three types of generic software. 2. Give one advantage and one disadvantage of each of these: templates, style sheets and wizards. 3. How do master documents, style sheets and templates help when working in a team?

#### Keywords

templates style sheets wizards

#### **School and college administration**

#### Bullets

Administrative tasks:

- registering pupils,
- reporting to parents,
- managing exam entries
- manage budgets
- communication with parents and outside agencies
- 
- 
-

- 

### Text

Staff at schools and colleges have a large number of administrative tasks to carry out, including registering pupils, reporting to parents, managing exam entries etc. There are a number of ICT systems that can help in the process. Database applications can be used to store pupil records, spreadsheets can help manage budgets and word-processing packages can be used in communication with parents and outside agencies. With an intranet or an Information Management System staff can share information about student progress with one other.

### Advantages of using ICT for Administration

- Improved speed of access to data - faster editing/ amending/ deleting/searching for information to match specific search criteria
- A variety of output formats available
- Faster and simpler to transfer data
- Saves time when reproducing standard letters
- Increased security
- Saves on storage/office space

### Disadvantages of using ICT for Administration

- Expense in training staff
- All staff have to be committed to using the system
- Regular backups must be made to ensure data security
- Confidentiality - staff may forget to log off or lock their computers

### Questions

1. Identify three different potential users of an ICT package to track pupils' grades and achievements.

### Keywords

outside agencies standard letters backup training confidentiality

### **School Attendance**

### Bullets

Several ways of recording students' attendance:

- OMR sheets
- Radio signals
- Smart cards
- Retina Scans
- Advantages:
  - Know which students are in and are late
  - Know where students are all times
  - Printout report summary
- Disadvantages:
  - Wireless coverage may not be available
  - Initial cost
  - Cost of maintenance and repair

- Over reliance on the technology

### Text

There are several ways of recording students' attendance:

#### Optical Mark Reader (OMR) Forms

OMR forms use optical mark sensing. Teachers are given OMR class lists each week and pencil black marks in the boxes which correspond to whether the student is present or absent. For absentees, the teacher also puts a mark in the box that corresponds to the correct reason for absence. The form is read by a computer scanner which is sensitive to the amount of light reflected back from the form, and thus can identify where the black marks are - from this a list of absentees and reasons is produced.

#### Radio signals

In some school each teacher has a hand-held or laptop computer with a wireless link to a central computer in the main administration office. The teachers fill in an electronic attendance form on the computer at the beginning of every lesson and this is transmitted to the office wirelessly. The system can even dial out to parents of absent children with a pre-recorded message asking the parent to contact the school. An example of this system is called 'BROMCOM'.

#### Smart Cards

Each student has their own smart/swipe card which they swipe through an electronic card reader, linked to a computer, at the beginning of registration and/or each lesson. This data is sent to the main office either by wireless or by file transfer.

#### Biometric devices

Iris-recognition and fingerprinting devices that decode the unique configuration of the students' eyes and/or fingerprints can be used to check if a student is present/ has entered the classroom.

#### Advantages

- Know which students are present, absent or late
- Know where students are at all times if Year Tutor wants to see them
- Printout report summary to check students' percentage attendance.

#### Disadvantages

- Wireless coverage for all rooms may not be available
- Initial cost of purchasing the electronic equipment
- Cost of maintenance and repair – needs technical support
- Students might swipe their friends' cards into a lesson - teacher has relied upon the machine to do it and not checked visually.

### Questions

1. Why is an ICT-based system of registration better for the school administration than the old paper register method ?

### Keywords

intranet biometric devices

### **Health**

### **Sensors and Computer Control**

### Bullets

- Sensors are mainly used to measure heart rate, breathing rate, blood oxygen, pulse and temperature.

- Their readings are used as Digital and/or Analogue inputs to computer systems.
- Can assist in performing repetitive tasks and signaling alerts if a problem arises.
- Can monitor a patient without the need for human observation - nurses free to do other tasks.
- Equipment can be costly.

### Text

Sensors are widely used in hospitals to monitor and record a patient's condition. They are mainly used to measure a quantity such as heart rate, breathing rate, blood oxygen, pulse and temperature.

The sensors are connected to a computer and their readings are used as input. The data is analysed and displayed on a monitor or used to initialise alarm systems.

Some sensors are analogue (e.g. temperature) where the readings may be any value in a continuous range, and some are digital (pulse rate) with a possible set of distinct values.

There are many uses to Computer Control within patient care. In the Intensive Care Unit of any hospital, if a patient's blood pressure drops to a dangerous level an alarm will sound, alerting the nearest doctor - the doctor should know then exactly what the problem is.

Computer control is also used in most wards these days. If a patient requires a drip, it is a computer that is responsible for releasing the drip into the patient's body every so often. If this computer were to fail, it could be life-threatening to the patient.

Maternity wards have recently started using computer control. When a child is born a wristband, which contains a sensor, is given to the child. If for some reason the child is taken out of the ward, an alarm sounds alerting nurses that a certain child has left.

### Questions

1. What are the advantages of using sensors in a medical situation? 2. Give examples of sensors that could be used in patient monitoring?

### Keywords

sensor monitor analogue digital

### **MRI - Basic Idea + How it works + Future Development**

#### Bullets

- Uses super-conducting magnet and radio waves.
- Computer builds 2D or 3D images.
- Patients with metal pacemakers etc may not be eligible for MRI treatment.
- Does not use ionising radiation.

### Text

MRI (MAGNETIC RESONANCE IMAGING) is one of the most powerful diagnostic scanning tools available to hospitals. It is helping to improve the health and quality of life of millions of people by improving the level of the diagnosis.

An MRI machine looks like a giant cube with a horizontal tube running through it. It is a very powerful super-conducting magnet, with the patient sliding into the tube on a special table and lying at the centre of the magnetic field.

Using coils specially made to fit different areas of the body, the patient receives pulses of wave energy (RF). These pulses bounce back from the patient's tissue, and can be detected by the MRI machine. Different tissues will bounce energy back differently, and damaged or abnormal tissue is easy to spot.

Normal and abnormal tissue will respond differently to this slight alteration, giving us different signals. These varied signals are transferred into images, allowing us to visualise many different types of abnormalities and disease processes.

The MRI scanner can focus on a very small area of the patient's body and use computer processing to produce an image. The body can be mapped out point by point to create 2-D images or 3-D models. The level of detail is extraordinary and, by varying the magnetic fields and RF frequencies, can be tailored to the particular medical question being asked.

The magnet is so powerful that it could lift a car - and care has to be taken that loose metal objects (including paper

clips, pens, scissors, stethoscopes, even trolleys) are not in the area when the machine is switched on. Some patients (e.g. those with heart pacemakers) may not be suitable for this type of diagnosis due to the strength of the magnetic field, but fixed metal objects such as tooth fillings and replacement hip joints are usually ok.

#### Questions

1. Discuss the advantages and disadvantages of MRI over one other named method of medical scan.

#### Keywords

Magnetic Resonance Imaging super-conducting magnet.

#### **MRI - Advantages + Disadvantages**

##### Bullets

###### ADVANTAGES

- Non-invasive treatment
- Excellent for diagnosing, visualising and evaluating problems such as cancer tumours.
- Can be noisy and claustrophobic.
- Expensive.

##### Text

###### ADVANTAGES

- Non invasive process - patient does not need to be cut open
- Patient does not require a 'contrast' injection (as in vascular radiology)
- Does not use ionising radiation, which is a comfort to many patients
- Very few side effects
- MRI can produce images in any plane (x, y or z axes) from a single scan (unlike with X rays, where you have to move each time you need a different picture)
- High resolution images
- Ability to tailor the examination to the type of tissue in question
- Excellent for diagnosing (Multiple Sclerosis (MS) / tumours of the brain / infections of brain, spine or joints / early stages of strokes etc)
- Excellent for visualising (torn ligaments, shoulder injuries etc)
- Excellent for Evaluating (bone tumours / cysts etc)

###### DISADVANTAGES

- Many people cannot be scanned because of metal complications (pacemakers / recent surgery involving metal staples / metal splinters in eyes (eyes never develop scar tissue to hold splinters in place)
- Some people are too big to fit into the scanner
- Most hospitals prefer not to image pregnant women, due to lack of research on effect of magnetic fields on the developing foetus
- Some people feel claustrophobic inside the scanner
- The machine is very noisy during a scan
- Patients are required to hold still for long periods of time (up to 90 minutes). Slight movement may necessitate a re-scan
- Metal hardware (screws, plates, artificial hip joints) inside the patient is ok once scar tissue has formed to hold it in place (6 weeks) but may still distort the image - and a uniform field is essential for good imaging
- MRI systems are very expensive to purchase, and therefore the examinations are also very expensive

FUTURE DEVELOPMENTS: MRI scanners are becoming smaller, lighter and yet able to scan larger patients. They are becoming more powerful and patient-friendly, resulting in reduced scan times and less anxiety / claustrophobia.

### Questions

1. MRI uses a very powerful magnet. Describe why some patients may not be suitable for MRI treatment.

### Keywords

Magnetic Resonance Imaging. Non invasive. Non ionising.

### **CAT Scanners**

#### Bullets

- Type of X-Ray imaging.
- Beam moves around patient to build 3D image.

#### Text

CAT (COMPUTERISED AXIAL TOMOGRAPHY) is a development of X-ray imaging.

The CAT scanner also produces X-ray beams, which pass through most of the soft tissues of the patient's body onto arrays of X-ray detectors (instead of the conventional photographic film)

The problem with conventional X-rays is that they produce 'shadows' in one direction only. A larger bone may be directly in front of a smaller one and obscure the image. The only way to see the smaller bone would be to take another X-ray, this time from the side and try to visualise the result. In a CAT scan machine, the X-ray beam moves all around the patient, scanning from hundreds of different angles. The computer takes in all this information and puts together a 3-D image of the body.

#### SCANNING PROCEDURE

The CAT machine looks like a huge doughnut stood on its side. The patient lies down on a platform which slowly moves through the hole in the machine. The X-ray tube is mounted on a movable ring around the edges of the hole. The ring also supports an array of X-ray detectors directly opposite the X-ray tube.

A motor turns the ring so that the X-ray tube and X-ray detectors revolve around the body of the patient. Each revolution produces a narrow, horizontal 'slice' of the body. The control system also moves the platform further into the hole so that the tube and detectors can scan the next slice, thereby recording slices in a spiral motion. After the patient passes through the machine, the computer combines all the information to form a detailed image. Of course, it is not usually necessary to scan the whole body, and doctors will often scan only a small section.

### Questions

1. Describe the main differences between CAT scans and conventional X-ray techniques.

### Keywords

X-ray imaging 3D image

### **CAT Scanners - Advantages + Disadvantages**

#### Bullets

##### ADVANTAGES

- CAT scans provide much more information than conventional X-rays
- 3D X-ray images are built up from a single scan
- Excellent for diagnosing head trauma / cancer / osteoporosis
- Cheaper than MRIDISADVANTAGES
- Use ionising radiation, which is more dangerous than MRI
- Not suitable for pregnant women

#### Text

##### ADVANTAGES

- Since they examine the body slice by slice, from all angles, CAT scans are much more comprehensive than

- conventional X-rays / provide much more information
- Excellent for diagnosing head trauma / cancer / osteoporosis.
- Much cheaper than MRI
- Do not affect pacemakers (no magnetic field effect)

#### DISADVANTAGES

- Use ionising radiation, which is more dangerous than MRI, especially if several scans are needed.
- Not suitable for pregnant women because of ionising effect of radiation

#### Questions

1. Describe the advantages of CAT scans over MRI scans. 2. Why might a pregnant woman not be suitable as a candidate for a CAT scan?

#### Keywords

Computerised Axial Tomography (CAT) X-ray 3D images

#### **Ultrasound**

##### Bullets

- Uses high frequency sound.
- Computer processing produces 2D/3D images.
- The probe can be moved along the surface of the body and angled to obtain various views

##### Text

ULTRASOUND uses high frequency sound waves and their echoes (rather like bats, whales, dolphins and submarine SONAR)

- The ultrasound machine transmits high-frequency (1 to 5 megahertz) sound pulses into your body using a probe
- The sound waves travel into your body and hit a boundary between tissues (e.g. between fluid and soft tissue, soft tissue and bone)
- Some of the sound waves get reflected back to the probe, while some travel on further until they reach another boundary and get reflected
- The reflected waves are picked up by the probe and relayed to the machine
- The machine calculates the distance from the probe to the tissue or organ (boundaries) using the speed of sound in tissue (5,005 ft/s or 1,540 m/s) and the time of each echo's return (usually of the order of millionths of a second)
- The machine displays the distances and intensities of the echoes on the screen, forming a two dimensional image like the one shown below.

In a typical ultrasound, millions of pulses and echoes are sent and received each second. The probe can be moved along the surface of the body and angled to obtain various views

#### THE ULTRASOUND MACHINE

A basic ultrasound machine has the following parts:

- transducer probe - probe that sends and receives the sound waves
- central processing unit (CPU) - computer that does all of the calculations and contains the electrical power supplies for itself and the transducer probe
- display - displays the image from the ultrasound data processed by the CPU in b/w or colour
- keyboard/cursor - inputs data and takes measurements from the display
- disk storage device (hard, floppy, CD) - stores the acquired images (often on CD with the patient's file)
- printer - prints the image from the displayed data

### Questions

1. Describe the main differences between ultrasound and medical scanning techniques which use ionising radiation.

### Keywords

transducer probe

### **Ultrasound - Advantages and Disadvantages**

#### Bullets

- More informative than conventional X-rays.
- Does not use ionising radiation - particularly useful in gynaecology.
- Cheaper than MRI to buy/ operate.
- No affect on pacemakers and metal prosthetics.

### Text

#### ADVANTAGES OF ULTRASOUND

- 3D imaging allows you to get a better look at the organ being examined and is the best method for early detection of cancer
- Structures can be observed without using ionising radiation
- Ultrasound scans are much faster than X-rays or other radiographic techniques

#### DANGERS OF ULTRASOUND

There have been many concerns about the safety of ultrasound. Because ultrasound is energy, the question becomes "What is this energy doing to my tissues or my baby?" There have been some reports of low birth-weight babies being born to mothers who had frequent ultrasound examinations during pregnancy. The two major possibilities with ultrasound are as follows:

- development of heat - tissues or water absorb the ultrasound energy which increases their temperature locally
- formation of bubbles (cavitation) - when dissolved gases come out of solution due to local heat caused by ultrasound

However, there have been no substantiated ill-effects of ultrasound documented in studies in either humans or animals. This being said, ultrasound should still be used only when necessary (i.e. better to be cautious)

### Questions

1. Some doctors are concerned that Ultrasound may lead to cavitation (bubbles of air forming in the tissues). What other possible side effects might a cause for concern when using Ultrasound?

### Keywords

Ultrasound transducer / transduce probe gynaecology cavitation

## **Ultrasound - Uses and Future Developments**

### Bullets

- Wide range of uses includes gynaecology (pregnancy), cardiology (heart) and cancer detection.
- Some worries about heat produced in tissues.
- Becoming smaller, cheaper and more portable. Will eventually be part of ambulance/paramedic kit.

### Text

#### **MAJOR USES OF ULTRASOUND**

Ultrasound has been used in a variety of clinical settings, including obstetrics and gynaecology, cardiology and cancer detection.

- checking that the foetus is in the normal 'head down' position ready for birth
- ascertaining the number of foetuses in the uterus
- checking the sex of the baby (if the genital area can be clearly seen)
- viewing tumours of the ovary and breast
- seeing the inside of the heart to identify abnormal structures or functions
- measuring blood flow through the heart and major blood vessels
- measuring blood flow through the kidneys
- viewing kidney stones
- detecting prostate cancer early

#### **THE FUTURE OF ULTRASOUND**

As with other computer technology, ultrasound machines will most likely get faster and have more memory for storing data. Transducer probes may get smaller, and more insertable probes will be developed to get better images of internal organs. Most likely, 3D ultrasound will be more highly developed and become more popular. The entire ultrasound machine will probably get smaller, perhaps even hand-held for use in the field (e.g. paramedics, battlefield triage- deciding which casualties need care most urgently). One exciting new area of research is the development of ultrasound imaging combined with heads-up/virtual reality-type displays that will allow a doctor to "see" inside you as he/she is performing a minimally invasive or non-invasive procedure such as amniocentesis or biopsy.

### Questions

1. Describe why ultrasound is so useful when checking on the progress of a developing foetus. 2. Other than gynaecology, describe the main uses of ultrasound in clinical diagnosis.

### Keywords

gynaecology cardiology cancer detection future portability

## **Electronic Patient Record Keeping**

### Bullets

- Medical records are used to capture patient information at time of referral from a GP
- The records form a basis for planning the patient's care and treatment
- The records may be passed on to a Hospital or Clinic and viewed and used by Doctors and staff during a patient's referral and treatment

### Text

Medical records are used to capture patient information at time of referral from a GP, some of which may already be on file if the patient is known to the practice. These records hold information about the initial assessment and diagnosis of the patient's condition and prescription. The records form a basis for planning the patient's care and treatment, getting feedback on their progress and suggesting action for prevention and health promotion. The records may be passed on to a Hospital or Clinic and viewed and used by Doctors and staff during a patient's referral and treatment. Medical record keeping is a legal requirement that the Health Service must comply with. Hospitals and Health Trusts use medical records to assess and provide information about clinical management, staffing levels, self-

evaluation, audits and quality assurance.

Poor record keeping undermines patient care, increases the workload on staff and may lead to legal and professional problems.

#### Advantages of Electronic Patient Record Keeping

Improved legibility of records

Better accountability - who did what, when?

Standardization of information and formats

Ease of information retrieval, by searching

Secondary information support e.g. lists, aide memoir

Speed of data processing aids quick analysis, and helps define priorities

Saves time on note writing.

Facilitates evaluations of nursing care

Audit trails

'Instant' benefits in research and audit applications.

Properly designed and implemented systems can help support Doctors and clinicians

#### Questions

1. What information is kept on an electronic patient record? 2. What use is made of patients' records after the initial recording of data? 3. What problems may arise if records are inaccurate?

#### Keywords

### **Blood Bar coding and Tracking systems**

#### Bullets

- Blood is tracked from the moment it is donated
- A computer system (PULSE) is used to store a unique donation number
- Blood samples are then taken for safety tests in the labs
- Blood is stored in a temperature controlled blood bank
- It's vitally important that the right blood gets to the right patient
- Safety checks are made automatically before the blood is given by tracking the bar-coded bags, patient barcodes and staff barcodes
- The barcode for the prescribed blood for a patient is stored in the computer tracking system

#### Text

During 2005, 2.1 million blood donations were given by 1.6 million donors. That's 5% of the population, giving two or three times a year.

The blood is tracked from the moment it is donated. A computer system (PULSE) is used to store a unique donation number which is issued at the session. Labels with this number and bar code are placed on the blood bag and samples. The blood samples are then taken for safety tests in the labs. These tests look for infections that can be passed from donor to patient. The blood is kept in a quarantine fridge until all the tests are completed with negative results. Then the blood is labelled with its blood group and becomes ready for issue to the hospital. Throughout its life it is stored in a temperature controlled blood bank. The right temperature is important to help keep the cells alive and inhibit bacterial growth.

Blood transfusions are an area of extreme risk for the patient, where inaccurate identification can lead to potentially fatal errors. Blood bags are routinely bar-coded and labelled with their type, but when the bags are issued from the blood bank, it is important that the right blood gets to the right patient. Safety checks are made automatically before the blood is given by tracking the bar-coded bags, patient barcodes and staff barcodes.

When a Doctor prescribes a blood transfusion for a patient, the information is stored in the computer tracking system. This allocates the right blood bag from the blood bank to the patient.

A single nurse then takes the bag to the patient's bedside. He/she is prompted by the computer system, in order, to read the bar codes on his/her identity badge, the patient's wristband and the blood bag tag.

#### Questions

1. Why is donated blood tracked with barcodes? 2. Why must the right blood be given to the patient? 3. Why is a

computer system implemented over another system to keep records?

#### Keywords

barcode computer tracking system

#### **Use of Internet, Intranets and Extranets**

##### Bullets

- Internet allows open access to pages, pictures and files.
- Intranet allows internal access to pages, pictures and files within the organisation
- Extranet allows a secure connection into the organisation's Intranet

##### Text

Computer networks are used to pass information from person to person and computer to computer.

##### Internet.

The Internet is used as a means of passing data from computer to computer and between people. It is a suitable system for showing websites, sending e-mail and file attachments. This information may be for general public viewing, or for e-mails which do not need to be totally secure. It is intended for home use or passing non-critical information. Web pages, pictures and files are kept on registered web-servers.

##### Intranet.

An Intranet is used when the information within the computer system needs to be more secure. This internal network is protected from outside viewing. It's usually contained within a building or group of buildings in close proximity, where users have to log-in with usernames and passwords. It uses software based on Internet technology. The e-mail system may be kept internal only to those users with access rights; the website may only be viewed by those within the establishment.

##### Extranet.

An Extranet is a combination of the two systems: Internet and Intranet. It allows authorised remote users who may work from home or remote office to use their telephone (Internet) connection to log-in to their work network (Intranet) located in their main office building. This link is kept secure and may be encrypted. This allows the user to remotely access their work e-mail system, shared files, internal website, videoconferencing etc. They may transfer files from their PC to the main office server.

##### Questions

1. Why would the NHS implement an Intranet rather than use the Internet for displaying information? 2. What recent developments in IT within the health service have caused the change for Intranets to become Extranets?

##### Keywords

internet intranet extranet encryption

#### **Distributed Medical Databases**

##### Bullets

- The "Health and Social Care Information Centre" is to co-ordinate and streamline the collection and sharing of data in the NHS
- The creation of a central NHS network poses many problems
- Presently, GPs, hospitals and trusts use many different computer based recording systems

##### Text

On Friday 1st April a new organisation came into being in the NHS- the "Health and Social Care Information Centre". Its purpose - to co-ordinate and streamline the collection and sharing of data about Health and Social Care. It also plans to be the central point for anyone who needs information; patients, clinicians, managers or regulators. As well as providing information, the Information Centre (IC) is reviewing how information is collated and managed centrally.

"Our aim is to deliver the data and information resources needed by Health and Care professionals to run services and inform the public. We will start by co-ordinating existing information channels and identifying gaps in delivery and capability".

The arrival of the computer based record form especially in its distributed, networked form poses several concerns for health care staff:

- Control of the accessibility of information.
- Personal accountability.
- Recognition that the clinical and social welfare workers from organisations with different management structures/funding need to share information.
- Time to train.

GPs and hospitals have traditionally implemented their own systems for record keeping. The greatest challenge for the designers of the new central system is to meet the demands of each sector of the Health Service and to integrate and evolve all the different information systems into one.

#### Questions

1. What are the advantages to the NHS of a central network? 2. What are the problems associated with implementing this new system?

#### Keywords

accessibility of information personal accountability

#### **Backup and Recovery Procedures**

##### Bullets

- Computers are apt to break down eventually
- A copy of all files should be kept on another disk for safe keeping
- Backups can be made on a weekly, daily, or continual basis
- A backup policy should be written and implemented
- Broken hard drives may be replaced and data restored

##### Text

Backup.

Even the most reliable computer is apt to break down eventually. A copy of all files should be kept on another disk for safe keeping. This data may be restored to its original location in case of disk failure. Backups can be made on a weekly, daily, or continual basis.

In its simplest form, a backup of a file is made to a floppy disk, removable USB drive, recordable CD, etc.

Data from desktop computers may be backed up onto CD, DVD, external hard drive, or tape drive.

Data in a server may be kept safe initially by mirroring / duplexing two hard drives. The second hard drive continually copies everything found on the primary hard drive. In the event of failure, the drives may be swapped. This is known as RAID1.

In larger servers where the volume of data is too large for backup tapes, the hard drives may be set-up in further RAID (Redundant Array of Independent Disks) configurations. RAID5 stores data on multiple hard drives by splitting up the data and accessing all of the disk drives in parallel. In event of one hard drive failure no data is lost, and a new drive may be put in its place.

For further security, a server may be set-up in RAID5 and then further mirrored by another server of similar configuration. This system may be scaled up until two buildings are required with independent electrical sources, to house all the data systems. At these levels of data security, the computer system will automatically switch away from the broken server and seamlessly continue by using the secondary unit.

Backup Policy.

The organisation has a responsibility to its customers and clients to keep their data secure from loss and corruption. E.g. A clinic will keep all patient details safe and prevent their permanent loss. The organisation also has a responsibility to itself and its employees to prevent data loss which could result in bankruptcy, closure or loss of jobs. E.g. An e-commerce business could cease trading within days should they lose their stock, customer and transaction details. This responsibility is given to the IT department to ensure that an effective backup policy is implemented. A policy would determine:

Who takes responsibility for backup procedure

How often the backup is kept

Organisation and archive of the storage media

Safe storage of disks, tapes and drives in offsite or fireproof location

The actions taken in the event of disaster

Test that the backup media is usable and effective in case data has to be restored

Restore.

Data needs to be restored when the data becomes corrupt or the hard drive of a computer fails. A new drive is put in place and the data copied back from the backup media, i.e. disks or tape. Tape drives are generally slow and the process may take many hours depending on the volume of data. Ten or more tapes would be used to implement a typical Grandfather-Father-Child system where the tapes are used in numbered sequence, this allows data to be restored from a number of weeks previous. In larger computer systems restoring data in this way may not be possible due to the complexity of the system - here the systems are designed so that data may never be lost even when drives are removed and replaced.

Questions

1. Why should backups be made? 2. What determines what media is used on which to save the backup files? 3. What is described in a Backup Policy?

Keywords

backup backup policy restore

**New and Future Developments and Limitations**

Bullets

- The technology available for Health and Care workers will allow them to become more mobile in future

Text

The technology available for Health and Care workers will allow them to become more mobile in future, and the new technologies will support this.

Hospitals are trialling the use of Radio Frequency ID to record vital signs via a barcode on the patient's wristband. In a matter of seconds the information is added to the patient's electronic record to keep data up to date and maximise patient safety.

The same technology could be used to tag drugs and prescriptions to track their progress through a hospital and match them to patients. Pilot schemes introduce the use of bleeper badges which are Wi-Fi-enabled hands-free phones. They operate via voice recognition, enabling clinicians to be called and link in to the phone network wherever they are within the hospital.

"The many benefits simply cannot be ignored. It means nurses will be able to prescribe from a patient's home. They will be able to access and record up-to-date information while visiting a patient. And patients will have the novel experience of only being asked a question once!"

Health Care staff in future can download their calendar in advance and use hand-held computers to keep in contact with their teams by e-mail rather than having to return to base to catch up. They can also text or phone their client in advance, from wherever they are, to make sure journeys are not wasted because of Do Not Attends (DNAs) or cancellations.

"Such partnership working is also enhanced by the use of easier, more legible, accurate electronic documentation which can be shared with patients and other clinicians to improve communication and patient safety."

Other benefits include tighter stock control as handsets are used to record the use of items and order their immediate replacement, enabling cost savings associated with weekly rather than daily stock collections.

Wireless technology will be available in hospitals, where PDAs or computers on trolleys can be moved from bed to bed. Staff may work remotely from home using their own computer hooked up to the NHS system through dial-up or home broadband. Staff may use PDAs to access the hospital network from a patient's home, using both wireless and remote technologies.

### Questions

1. How will mobile technology help Health and Care workers in future?

### Keywords

mobile technology Wi-Fi

### **Advantages of Electronic Patient Record Keeping**

#### Bullets

- Improved legibility of records
- Better accountability - who did what, when?
- Standardization of information and formats
- Ease of information retrieval, by searching
- Secondary information support e.g. lists, aide memoir
- Speed of data processing aids quick analysis, and helps define priorities
- Saves time on note writing.
- Facilitates evaluations of nursing care
- Audit trails
- 'Instant' benefits in research and audit applications.
- Properly designed and implemented systems can help support doctors and clinicians

### Text

Improved legibility of records

- Doctors are notorious for their illegible handwriting

Better accountability - who did what, when?

- Problems or mistakes made by people can be traced quickly, also, in a court case a hospital can prove that they followed the correct procedure when treating a patient

Standardization of information and formats

- Traditionally, doctors' practices had different ways of recording and storing patient information; these will be standardised into a common format used by everyone

Ease of information retrieval, by searching

- Searching an electronic database is much quicker than looking through mountains of paper records

Secondary information support e.g. lists, aide memoir

- Databases are set up to keep additional notes a doctor wishes to make which may not be possible on the paper forms

Speed of data processing aids quick analysis, and helps define priorities

- Example 1: Computers create a 3D picture from an MRI scan of a patient's internal organs which a doctor can study and diagnose
- Example 2: Doctors can quickly gather data from sensors attached to a patient in the A and E ward and decide on the course of action

Saves time on note writing.

- Use of menus and lists increase input speed

Facilitates evaluations of nursing care

- Performance statistics can be calculated from all the processed information

Audit trails

- Every action and job is traceable to an employee

'Instant' benefits in research and audit applications.

- A hospital's efficiency can be evaluated quickly

Properly designed and implemented systems can help support doctors and clinicians

- IT can help the doctor in their daily work

### Questions

1. List 5 advantages of electronic patient record keeping.

### Keywords

record feedback accountability audit trails

### **Expert System Advantages**

### Bullets

- Does not forget
- Stores more information
- Up-to-date
- Reliable
- Available 24/7

### Text

- ☒ The computer can store far more information than a human. It can draw on a wide variety of sources such as stored knowledge from case study books to help in diagnosis and advice.
- ☒ The computer does not 'forget' or make mistakes.
- ☒ Data can be kept up-to-date.
- ☒ The expert system is always available 24 hours a day and will never 'retire'.
- ☒ The system can be used at a distance over a network. So rural areas or even poorer developing countries have access to experts.
- ☒ Provides accurate predictions with probabilities of all possible problems with more accurate advice.
- ☒ Some people prefer the privacy of talking to a computer.

### Questions

1. State two advantages of using Expert Systems in some fields. 2. Describe how expert systems are there to aid the user.

### Keywords

knowledge base up-to-date

### **Expert System Disadvantages**

#### Bullets

- No common sense
- Over Reliance of using computers
- Information inputted to the system MUST be correct

### Text

- Over reliance on computers
- Some 'experts' could lose their jobs or not be given training if computers are available to do the job.
- Lacks the 'human touch' - lack of personal contact
- Dependent on the correct information being given. If data or rules are wrong then wrong advice could be given.
- Expert systems have no "common sense". They have no understanding of what they are for, nor of what the limits of their applicability are, nor of how their recommendations fit into a larger context.
- Expert systems can make stupid errors, such as prescribing an obviously incorrect dosage of a drug for a patient whose weight and age are accidentally swapped by the clerk.

### Questions

1. What happens to an Expert System if it is not up to date? 2. Describe 2 problems associated with using Expert Systems.

### Keywords

over reliance

### **Expert System other uses**

#### Bullets

- Used in variety of areas
- ASPRIN, PROLOG
- MYCIN early medical expert system in 1970's

### Text

Expert systems are used in a variety of areas, and are still the most popular developmental approach in the artificial intelligence world.

There are several special programming languages used to program these types of systems including ASPRIN and PROLOG

MYCIN was one of the earliest medical expert systems designed in 1970s. Its job was to diagnose and recommend treatment for blood diseases.

### Questions

1. What is the purpose of the MYCIN expert system?

### Keywords

artificial intelligence

### **Home**

### **Games**

#### Bullets

- Life like graphics give realistic gaming experience

- Easy these days to play games on-line or off-line
- High spec PC required for maximum experience
- Expensive games have short life span due to advances in technology
- 

### Text

An increasing number of people nowadays are using their computers at home to play games. This can be done by visiting an on-line games website, or by purchasing a game from a shop and installing it on the home PC. On-line gaming may involve interaction with many other players elsewhere on the Internet. Dedicated games 'consoles' (such as Xbox 360, PS3 and the Nintendo Wii) are also available on the market and offer superb graphics. On-line gaming may involve paying a subscription, although some games sites are free.

In order to gain the maximum gaming experience it is important to have a high spec PC with a good processor, graphics card and sound card. These can be very expensive and the trouble is, in order to keep at the top of this experience, you need to keep up with advances in the technology by buying newer and faster hardware.

### Questions

1. Why is it important to have a fast connection to the Internet if you want to play games on-line? 2. Is having a good specification important?

### Keywords

games photography music downloading music

### **Photography**

#### Bullets

- Much easier to manage photos by downloading them to PC and saving them to CD or printing them.
- Once equipment is purchased, digital photography is cheaper than traditional method of sending film off for development.
- Much more user-control of final product.

### Text

Digital photography has developed rapidly and at the top end of the market rivals the quality of traditional methods. Instead of focusing light onto a photographic film, digital cameras use electronic devices called semi-conductors to measure and record the amount of light. Gone is the need to send spools of film off to the developers, with payment, only to find later that half the photographs didn't 'turn out'. Gone also are the messy chemicals needed for amateur photographers to develop their own photographs at home. Instead, with digital photography, the user has complete control over the whole process ☺ and for free! Unwanted photographs can be deleted from the camera at any time, and others transferred to a computer for further processing and/or storage, either on the hard-drive or later on CDR or DVDR. Digital cameras have many features, including the ability to crop and/or resize images, to adjust the colour and/or light balance of photographs, to apply special effects such as sepia tints or posterisations, to offer automatic light metering in a variety of conditions ('point and click'), to 'stitch' shots together to create panoramas, and even to shoot video. Photographs are stored on the camera on memory cards with capacities commonly (in 2007) up to 4Gb or 8Gb, and are easily transferred to the computer via USB connections (the camera is seen as a removable disk) or card readers. Once on the computer, photographs can be edited using application software such as 'Adobe Photoshop' or 'Microsoft Office Picture Manager' and then shown as slide shows (via a digital projector) made into screen-savers and so on. Digital photographs can be uploaded onto photo sharing sites on the Internet, such as 'Face-Book' or 'Flickr' and made available to friends for viewing. Photos can also be sent as email attachments, although consideration should be made as to file size and respective download times. Digital photographs can be printed out at home on a range of printers and be of 'photo quality' ☺ rivalling the quality of traditional photographs, especially when using special 'glossy' photographic printer paper.

There are concerns that digital cameras, like mobile phones, rapidly become out of date, and contribute to our 'throw-away' society and the environmental waste it produces. Because so many mobile phones include digital cameras, many unsolicited photographs and videos are now appearing on the Internet and can contribute to the modern social menace of 'Cyber-Bullying'.

### Questions

1. Compare and contrast the use of photography at home in the 1980s and nowadays.

### Keywords

portability edit pictures create movies photo quality memory card photo-sharing sites on Internet

### **Music**

#### Bullets

- Many people download music from the Internet, even though this is often illegal because of copyright laws.
- MP3 players make portable music possible.
- MP3 is a compressed file format but retains most of the original quality.
- Napster was a file sharing application which was closed down due the high number of transfers of songs in a few days

### Text

The Internet has revolutionised the business of popular music because it is now so easy to download music files directly from the web, rather than buying music CDs from a shop. Unfortunately this has also meant that copyright has not been paid, and various law suites have been brought about to challenge the right of people to use peer-to-peer client software such as 'Limewire' to create copies of music recordings. (In February 2001 a file sharing program called 'Napster' was taken off the Internet after over 300,000 files of 'Metallica', an American heavy metal band, were traded illegally in just 3 days). Apple Computer Inc. has since set up a site called 'iTunes', with digital music management software, and for a modest fee songs can be downloaded - but in an attempt to stop copying they can only play on the computer onto which they have been downloaded.

MP3 players, which can store literally thousands of MP3 files (sounds, pictures and videos) have become very popular because they are small enough to be portable, and people can listen to their music wherever they go. (MP3 music files, which are compressed to only one tenth of their original size, still retain close to CD quality - and are readily available for download on the Internet). The Apple 'iPod' is a popular example, but like other MP3 players is expensive, attractive and hence a target for thieves.

### Questions

1. Find out what is meant by 'copyright' and explain why it is a problem often associated with on-line music. 2. Why do companies sell music albums cheaper on the Internet than they do in the shops?

### Keywords

iTunes MP3 file compression File-sharing applications copyright issue

### **Creating Own Music**

#### Bullets

- Composing
- MIDI
- Notators
- Sound-wave editors
- Downloading Music

### Text

Back in the 1970's musicians found it quite difficult to record an album in a studio. This was mainly due to the fact that it was impossible to edit music once it was recorded. Nowadays it is possible, by using keyboards and a MIDI sequencer, to capture the music into a piece of software such as 'Sibelius' or 'Cubase'. It is then possible to edit tracks, change the tempo (slow or fast), transpose or even change the instruments available. These musical composition programs are relatively expensive pieces of software but are very popular with musicians all over the world. It is also possible, by using Notator software, to input the notes into the PC by using traditional input devices, note by note. A third type of software available to the public, Sound Wave Editors allows users to edit sound waves, mainly to get rid of

'noise'.

### Questions

1. Why would a composer want to input music into a computer rather than write it out on paper? 2. Explain how a musician could use 'copy and paste' when composing music on a computer.

### Keywords

Notating Software MIDI

### **Digital TV**

#### Bullets

- Changed lives by making most things available from the lounge
- Encourages gambling
- Will carry on developing
- Only 999 pages of Teletext
- Hidden Costs
- 

#### Text

The most popular digital TV service in the UK these days (2007) is SKY Television. SKY is interactive - this means the user has inputs into the process. There are other companies that offer digital TV, but SKY is one of the most common in the UK.

Digital TV is received by cable or satellite and customers need a 'digibox' to receive these signals. Some companies try to lure customers into using their system by offering free installation or even free hardware.

Digital TV offers more services to its users but these services do cost extra. The services available include shopping, betting, voting, home-banking, dating, games, pay-per-view sports and movies.

There are many problems due to digital TV: these range from lack of social interaction to cost issues. If a person was to do everything from an armchair in front of the TV he/she would not have the opportunity of mixing with others and therefore would lack the social interaction. Some people can get addicted to voting as it is so easy to access. Games can cost up to 75p a minute to play, but these costs are usually hidden!

Teletext is a TV service that displays information in the form of text. It was developed in the 1970s to give the user a way of searching for information on recent news events, sports, weather, and TV listings etc. A major problem is that Teletext is limited to only 999 available pages, and even then you need a good TV signal in order to use the service to its full potential.

Teletext is a one-way service (viewers can read information screens) whereas Digital TV is an interactive two-way service (viewers can purchase goods, watch selected movies etc).

### Questions

1. Describe two ways in which digital TV has changed the lives of ordinary people for the better. 2. Describe two disadvantages of using digital TV. 3. What are the costs involved in companies trying to lure new customers?

### Keywords

Shopping Betting Dating Cinema and Holiday Booking Home banking Voting Pay per view events

### **Mobile Phones**

#### Bullets

- No need to be at home to send/receive calls.
- SMS (texting) has revolutionised way we communicate with each other.
- Mobile phones can take and send photographs.
- 

#### Text

Mobile phones were introduced to the market back in 1983. Currently (in 2007) mobile phones are used by almost everyone as they are a very convenient method of contacting a person that isn't necessarily 'at home'. In addition to making telephone calls it is possible to send/receive text-messages (Short Message Service or SMS), and take

photographs and send/receive picture messages (Multimedia Message Service or MMS). With some mobile phones you can actually surf the Internet by using Wireless Application Protocol (WAP) which allows Internet content to be made visible on the mobile phone screen.

As with most things related to technology there are many advantages and disadvantages to using mobile phones. Advantages include the ability to communicate with people anywhere and from anywhere, not just from home (providing there is a signal). There are a variety of services available with mobile phones, and some are like Personal Digital Assistants (PDAs) with the options of calendars, alarms, and task schedulers etc. In Japan, the government uses the mobile phone networks to warn citizens of impending earthquakes!

The disadvantages of using mobile phones are that they depend on batteries, which need regular recharging, and that network coverage does not yet extend to all parts of the UK, which can be frustrating. Also, some doctors believe that the use of mobile phones, particularly amongst young people, poses a health problem due to the radiation they emit. People using expensive mobile phones in cities have become the target of muggers.

### Questions

1. Describe a social issue that is associated with the use of mobile telephones. 2. Compare and contrast a landline telephone from the 1960s to a modern mobile telephone.

### Keywords

Short Message Service (SMS) Multimedia Message Service (MMS) Wireless Application Protocol (WAP) Battery Life Social / Moral Issues

### **Internet**

#### Bullets

- Available 24/7
- Very cheap
- Fast and easy way to obtain information
- Ability to communicate with people all around the world at the price of a local phone call
- Online Shopping
- 

### Text

The Internet is a Wide Area Network (or more accurately it is a huge collection of networks connected together by what are called Gateways, making the system act as if it were one single network)

In order to access the internet, you need the correct hardware and software. In addition to a computer system, a modem or a network card is needed, together with a broadband link. You also need communication software, provided by an ISP (Internet Service Provider) such as Freeserve, AOL, or BT, and Web Browser software, such as Microsoft's 'Internet Explorer', to be able to view the HTML (a programming language in which web pages are created) as pages on your computer screen.

There are many services available on the internet. Using 'search-engines', such as 'Google' or 'Yahoo', it is possible to search for any topic. The results of searches are summarized as lists of sites with their links - the user clicks on one of the links to visit that specific webpage. It is also possible to download software such as utility programs (e.g. virus scanners, spyware removal tools), games, application programs and upgrades to existing software etc.

Users of the internet can access bulletin boards and forums where they can post and respond to messages. They can also use 'chat lines' and engage in online, real-time 'chat' with other persons using an 'instant messaging program' (e.g. 'MSN Messenger') or via an internet chatroom.

Email is defined as being mail sent between computers. Email has changed many people's lives, making it much easier for them to communicate with each other. There are many advantages to using email over traditional post - it gets delivered more quickly, recipients do not have to be at home to receive their email (they can collect it anywhere where they have Internet access), and the same message can be sent simultaneously to many people anywhere in the world, virtually for free (once the system has been purchased). It is also possible to add files to emails (known as attachments) which can be in the form of photographs, pictures, documents and even sound or video.

With the arrival of the internet, many new on-line services have been made available, and it is now possible to book for

concerts, do online shopping, banking, voting and betting, all from the comfort and security of one's home.

#### Betting, Voting and On-line Booking Systems

Online betting has become very popular with gamblers due to the fact that it is now possible to gamble on the internet 24/7 without leaving the home. This encourages the gambling habit and further exacerbates the lack of social interaction. It is also possible to use the Internet to book theatre or cinema tickets and even holidays. These are examples of real-time transactions, and when the user starts the transaction the seat(s) is booked until the user completes the transaction or cancels it. It is possible with an online-booking system to choose a seat from a theater plan, for example, and you do not need to visit or call for the tickets as the process is completed online. Since you pay during the transaction using a credit card, you do not have to queue to pay just before the performance / flight. The service is also available 24/7 which makes it accessible to all kinds of different people. However, since the transaction is completed online, some members of the public might be worried about giving their personal and financial details over the Internet. Also, particularly when booking popular entertainment events, high demand can lead to system overload and subsequent failure.

#### Questions

1. Describe how school children could use an on-line bulletin board to aid them with their work. 2. There are many disadvantages to using chat lines: give two different disadvantages to using chat lines. 3. Should pupils be able to access any website in school? Discuss.

#### Keywords

Search engines Web Browser Internet Service Provider (ISP) Downloading Bulletin Boards Chatlines Email Online Booking E-commerce Online Banking Online Voting and betting

#### **Online Shopping Advantages and Disadvantages**

##### Bullets

- Convenience of shopping from home
- Price comparisons over large number of on-line stores possible hence cheapest prices
- Flexible ways to pay with EFT
- Delivery costs can be high
- Access to the internet is required
- Concerns about giving credit card details online

#### Text

##### Advantages

There are a huge number of commercial websites available, some of them even offering price comparisons between different stores, so that customers can 'shop around' for products at the cheapest prices. This competition in turn tends to reduce prices. Access to products is available 24/7 and ordering can be done from the security of home, with payment for goods usually being done on-line using a credit card and EFT. Most on-line shops offer a home delivery service which is especially useful for elderly or disabled people and people without cars. Many commercial sites offer additional convenience services, such as remembering personal and financial details, making further purchasing easier and simpler, and most reputable commercial sites offer secure on-line shopping whereby credit card transaction details are encrypted and protected from hackers.

##### Disadvantages

A computer system with access to the Internet may represent an expensive initial investment for many people. On-line shoppers are a target for computer crime, with fake websites being set up to steal information such as security numbers and credit card details from unwary customers – an activity is known as 'phishing'. Since customers are buying on-line, they do not have the opportunity of examining the products before buying. In addition, some companies may charge excessive amounts for delivery. It may be difficult for small High Street businesses to match the cut-throat prices offered by the on-line stores, resulting in socio-economic changes such as the demise of in-town shopping centres.

### Questions

1. How do online shops often manage to offer products at cheaper prices than those in the High Street ones? 2. Explain the term 'phishing' and what it means in regard to online shopping?

### Keywords

phishing security issues

### **Online Banking**

#### Bullets

- Done from anywhere there is Internet connection
- Done from security of home 24/7 and 365
- Needs unique security number to access / protect accounts
- Hacking is major concern ☹ puts many people off
- Some telephone charges for being on-line
- EFT moves money electronically between accounts
- EFTPOS is used at Point of Sales in supermarkets etc
- Electronic payment methods require security validation via PIN or CHIP & PIN

### Text

#### ON-LINE BANKING

'On-line banking' is a term used to describe financial transactions and payments performed over the Internet. With on-line banking, customers can do their banking outside of bank hours and from anywhere where Internet access is available. To be able to use on-line (Internet) banking, in addition to the obvious things such as a computer system with an ISP/ Internet connection and a valid bank account, customers need to create a unique security number in order to access their accounts and protect them from others.

There are many advantages to on-line banking: you do not have to leave the security of your home in order to view your bank statements, pay bills or transfer money from one account to another. It is also a service that is available everyday and all day, not just when the banks are open, and can save on travel costs and travel time. There are, however, disadvantages to on-line banking: hacking is a major concern when on-line and so there is always the worry that someone will steal your account details and use them for their own financial purposes. You also have to pay the telephone charges for being on the Internet.

#### EFTPOS

Banks can move money between one bank account and another electronically over computer networks. This is called Electronic Funds Transfer or EFT for short. This is useful since the card holder no longer needs to carry cash because every transaction can be paid for by using Debit or Credit cards. EFTPOS means using EFT at the Point Of Sale - buying goods in a shop with a card.

#### SECURITY

It is now possible to pay for goods using a variety of methods, including cash, cheques, store vouchers, Debit Cards and Credit Cards etc. All electronic methods (EFTPOS, money withdrawals at ATMs, on-line transactions etc) require some sort of validation. This is usually either through a Personal Identification Number (PIN) or a 'CHIP and PIN' system with cards, or a unique security code used to gain access to on-line accounts. Either way, it is vitally important to keep security details secure and hidden from others. Some people are reluctant to buy goods on-line because of the danger of being 'watched' by hackers who intend to steal their financial details.

### Questions

1. What advantages are there for a customer when using on-line banking? 2. Hacking is a deterrent to many people starting on-line (Internet) banking. Discuss the problem and the steps a bank could take to encourage its customers to bank on-line. 3. What does a customer need to access on-line banking?

### Keywords

EFTPOS on-line banking security card services - debit/credit card crimes and methods of prevention

## **Business**

### **FEATURES OF CAD/CAM PACKAGES**

#### Bullets

- CAD uses vector-based graphics
- Can create/manipulate virtual 3D images
- Designs can be produced in layers
- Different 'skins' rendered onto framework skeletons
- Links to analysis software
- Linked to CAM for computer controlled manufacture
- Input via digitisers and tablets
- Output via plotters
- 

#### Text

CAD packages are sophisticated software designing programs used by engineers, architects and professional designers to develop new products.

CAD programs use vector-based graphics (rather than bit-maps) which allow for complex manipulation of the image and greater levels of precision. Users can draw accurate straight lines or arcs of different types and thicknesses and create virtual 3D images from their data. Users can also view objects from different perspectives, and designs can be produced in layers to show different information e.g. electrical wiring, gas pipes and control systems in a factory. Framework skeletons can be produced and 'rendered' in a variety of 'skins' to create solid effects, e.g. a car can be shown as both a skeletal design and as a finished product.

When output from a CAD process is used to control a manufacturing process this is known as CAD/CAM (Computer Aided Design/ Computer Aided Manufacture). For example, a new design of alloy car wheel could be cut directly from a solid billet of aluminium by a metal-cutting lathe controlled by the computer CAD/ CAM software.

Designs created by CAD/ CAM software can be linked directly to other software for analysis. For example, engineers can test a new design of road-bridge to see if it will bend under heavy load. At the same time, the cost of steel and concrete needed to build the bridge can be worked out automatically from the designs.

#### **HARDWARE REQUIREMENTS**

Operations such as rendering images, rotating/ resizing are all memory intensive so that CAD systems require fast processors, large amounts of Random Access Memory (RAM) for smooth on-screen translations and large amounts of secondary storage to hold the software and files.

Input is normally via a digitiser and tablet, with output usually a pen-plotter or A3 laser printer. For CAD/ CAM there needs to be a mechanical device such as a CNC lathe linked to the computer.

#### Questions

1. Describe what is meant by 'CAD/CAM'. 2. Using an example, describe what benefits a CAD/CAM package could bring to a small engineering company. 3. CAD uses vector-based graphics. Describe the advantages of vector-based graphics over bit-mapped ones.

#### Keywords

CAD/ CAM vector graphics 3D renderings memory intensive CNC lathe

#### **Advantages / Disadvantages CAD/CAM**

#### Bullets

- Advantages when designing/ visualising new products
- Advantage of quality, consistency and productivity
- Disadvantages of cost and training

- May lead to job losses
- Increased employment opportunities for workers once trained

### Text

#### ADVANTAGES DISADVANTAGES OF CAD/CAM SOFTWARE

CAD software has huge advantages when designing and visualising new products, and by linking data to other programs (e.g. cost analysis) can make enormous savings in time taken for associated calculations. CAM leads to higher quality and consistency in the manufactured article. This in turn leads to reliability and increased productivity. CAM optimises use of raw materials, cuts down on wastage and hence costs. Factory working conditions are often cleaner, with the prospect of shorter working hours/ more leisure time for the workers. Proficiency with CAD/ CAM software is seen as a valuable commodity and can lead to increased employment opportunities for those skilled in its use.

However, CAD software is initially expensive to buy and users will require training in order to make the most of it. CAM requires expensive machinery linked to the computers and specialised training for the operatives. CAD/ CAM setups may lead to loss of jobs due to the increased efficiency, although new jobs will be created through the need for maintenance of software and computerised machinery.

#### EXAMPLES

Kitchen Design software allows customers to 'build' their ideal kitchens, including furniture and appliances selected from on-screen catalogues, and to visualise the final designs from any angle or by 'walking through' the virtual 3D images. Associated software will work out the total cost of the kitchens as each unit is added, allowing customers to make changes which reflect their budgets.

Home and Garden Design software allows walk-throughs of virtual gardens, with customers able to visualise their plantings as they would be during the flowering season, any other time of the year or indeed, in the future. Plants and garden furniture can be added from on-screen catalogues and costs calculated etc.

In the fashion industry, patterns for new trousers can be worked out using CAD software to minimise wastage when cutting out. The new designs are then fed into machines which cut out the new patterns precisely. Similarly, complicated knitting designs produced using CAD software can be transferred directly to knitting machines (CAM)

Industrial Product Design software linked to cutting machines (CNC lathes) is used in the design of car engine components which are then cut from solid metal.

### Questions

1. You are working for a company which designs and makes custom parts for the motor cycle industry (plastic mudguards etc). Write a letter to your boss explaining why you think a CAD/CAM system would be a good investment for the business. 2. You are the boss of a company which designs and makes custom parts for the motor cycle industry (plastic mudguards etc). One of your employees has written to you suggesting that a CAD/CAM system would be a good investment. Write back to the employee giving him/her FOUR good reasons why you will NOT be buying the system.

### Keywords

Computer Aided Design Computer Aided Manufacture Quality Consistency Reliability Productivity

#### **COMPUTER BASED SHOPPING SYSTEMS**

### Bullets

- Nowadays less dependence on cash
- Several electronic methods of payment
- Smart Cards have chip used for auto debit/ credit
- EFT is computer based WAN system used by banks to transfer money between accounts.
- Credit Cards and Debit Cards employ EFT.
- Encryption of credit card details offers security for on-line purchasing.

- 

## Text

### PAYMENT METHODS

Developments in ICT have led to a society with less dependence on cash. Alternative methods of payment include Credit Cards and Debit Cards (computers store the financial details), Cheques (processed by computers using MICR), Direct Debit (computers generate payments for regular bills) and Electronic Funds Transfer EFT (used for payment of wages and salaries). Nowadays many payments are made electronically ☐ in supermarkets, petrol stations, restaurants and ticket offices, for example.

Phone Cards can be used for telephone calls and Smart Cards containing a microchip can be used for automatic debit and credit.

### EFT

Electronic Funds Transfer (EFT) is a computer-based system used 24/7 by banks internationally to transfer money between customer accounts. Large mainframe computers are required and the software must be capable of handling large numbers of transactions per second. When a customer pays by EFT using a Credit Card or Debit Card, the card is 'swiped' through a reader that reads the details from the magnetic stripe. The reader is connected via a WAN to a central bank computer that checks the details of the proposed transaction against the customer's bank account. If funds are sufficient an authorisation code is sent back ☐ this has to happen within a few seconds or the customer will become impatient and a queue will build up at the Point of Sale (POS). If the response authorises the payment the sale is then completed.

### EPOS

Electronic Point of Sale systems (EPOS) are used at sales outlets. In addition to electronic funds transfer (EFTPOS) they facilitate automatic control of stock and give feedback on the sales performance of different products, which can then be analysed.

### LOYALTY CARDS

In the retail industry, Loyalty Cards (also known as Club Cards or Points Cards) are often given to customers to identify them as members of a loyalty scheme and to encourage loyal buying behaviour (this is potentially beneficial to the company). They look like credit cards and have a barcode or magnetic stripe that can easily be scanned at the POS. The customer can use the card as a form of identification when shopping at that store, and may either be entitled to a discount on the current purchase, or given an allotment of points that can be saved up and used for future purchases. Information given by the customer to the store when applying for the loyalty card may later be used in marketing.

## Questions

1. Cash is being used less and less to pay for goods in our modern society. Discuss four other methods of payment used by supermarkets. 2. Many stores offer loyalty cards to their customers. Discuss the advantages of loyalty cards to a) the customer and b) the store.

## Keywords

Credit/ Debit cards Cheques use MICR Direct Debit EFT EPOS EFTPOS Loyalty cards (Club or Points cards) Encryption

## **Computer Based Shopping 2 On-Line and E Commerce**

### Bullets

- On-line shopping offers shops large audience and reduced overheads - customers have wider choice and convenience of shopping from home.
- Danger of fraud shopping on-line.
- 
- 
-

## Text

### ON-LINE SHOPPING and E-COMMERCE

Shopping via the Internet (e-commerce) is taking an increasingly large share of the market. Products and services can be ordered from on-line 'virtual shops' and money transferred electronically to pay for them. Even small companies can now reach a far larger audience with an Internet web site, sending deliveries all over the world. Web-based businesses do not necessarily require a high street shop or the staff to run it, and hence overheads can be cut dramatically. Customers do not need to travel long distances to shops or struggle home with their purchases - particularly useful for those with disabilities.

Unfortunately, because anybody can set up an on-line business, there are fraudulent sites on the Internet claiming to sell goods which do not exist.

Because credit card details can be intercepted, there is a risk that criminals may pay for goods or withdraw cash using your account. As a result, many people are anxious about giving out credit card details on-line, despite assurances from businesses that encryption systems and secure links protect their transactions.

## Questions

1. Some people argue that on-line shopping will one day put all 'High Street' shops out of business. a) Say why you think they are wrong, and that there will always be a need for 'real' shops. b) Say why you agree with them and that 'real' shops are a thing of the past.

## Keywords

ecommerce Electronic Transferral of Funds (EFT) Worldwide market Lower overheads Fraud Encryption

### **Computer Based Shopping 3 Bar Codes and Pricing**

#### Bullets

- Information coded into series of black/ white stripes.
- Read by scanners which detect patterns of reflected light.
- Contain codes for country of origin, manufacturer and unique product identifier.
- Code for price not included.
- Bar code validated by check digit.
- European Article Number (EAN) printed underneath in case of scanner read-error.
- Used for product sales, library book loans, stock management, product tracking during assembly.
- Prices contained within separate easily-updated database - once product identified through bar code, price is looked up in database.
- Fast/ accurate product identification.
- Facilitates special pricing deals

## Text

### BAR CODES

Bar codes are used as a means of identification, and the pattern of black and white stripes represents a code. The codes are read by various sorts of scanners which detect patterns of reflected light and encode the data into computer-readable form. In supermarkets the bar codes contain codes for country of origin, the manufacturer and also have unique product identifier. The last number is a check digit ☐ used to validate the bar code (check that it has scanned properly). A unique number for that product, called an Article number (the most common article numbering system being the European Article Number or EAN) is printed beneath the bar code in case the reader has failed to read the bar code ☐ the operator can then key in the code for the product directly.

Bar codes are used for product sales in the retail trade, book loans in libraries, package tracking by delivery firms, stock management in warehouses and tracking of assembly-line manufactured goods e.g. cars, through stages of assembly. They are fast and accurate when dealing with product identification, but the data is fixed and cannot be edited.

### PRICING

Because of automated sales systems (Bar Code scanners/ EPOS etc) it is easy for supermarkets to organise their pricing of goods. The scanned bar code identifies the item to the computer and the computer then refers to a database of prices to find the price associated with that item. The bar code does not contain the price! Changes to the prices of

items are made simply by editing the database (and not by replacing the sticky labels or the bar codes on every individual item)

ICT-based systems can also offer the customer special deals such as 'three for the price of two' or 'buy one get one free', which are administered automatically through the computerised system and appear on the customers' printed itemised receipt.

### Questions

1. Explain why most shops put barcodes on their items for sale instead of labels with prices.

### Keywords

Coded information Country of Origin code Manufacturer code Unique Product code Check digit validation EAN Product Sales Product Tracking

### **OTHER METHODS OF DATA ENTRY**

#### Bullets

- MICR used by banks to read cheques offers increased security
- OCR detects characters (letters and numbers)
- OMR detects marks on pre-printed grid sheet
- 
- 
- 

#### Text

MAGNETIC INK CHARACTER RECOGNITION (MICR) uses characters printed with ink containing a magnetic substance. This is then read by sensitive machines which recognise the characters from the magnetisation of the ink. Bank cheques employ MICR to hold Sort Code and Customer Account information, but with the decline in use of cheques so is the use of MICR. For the processing of cheques, MICR is fast and highly efficient because it can be read by machines, and is resistant to forgery. Because the equipment is expensive, MICR is only used in situations where security is important.

OPTICAL CHARACTER RECOGNITION (OCR) uses a scanning device to read light reflected back from characters typed or hand-written on a page. The scanner creates an image of the character and software tries to match it against a library of similar character shapes. When a match is found it inputs the appropriate character. OCR is used to input large blocks of text held in 'hard copy' format, speeding up the process of keying in. Unfortunately, it often misreads letters, and documents captured in this way have to be proof-read afterwards. It is also used to capture data from forms such as Passport Application Forms, where each character is written in a box ☐ OCR systems must be able to read each character separately. Hand written characters must be clear and care must be taken to prevent smudges and marks being read as 'characters'. The postal services also use OCR to read postcodes by machine, speeding up the sorting process enormously.

OPTICAL MARK RECOGNITION (OMR) is a method similar to OCR but instead of characters OMR systems read pencil marks made on special pre-printed forms, with boxes to indicate choices. The scanning device shines a light at the page and records the amount of light reflected back from different parts - boxes containing dark marks will reflect less light. Each mark equates to a pre-set value and, once read, can be sent for processing. A good example of an OMR application is the filling in of National Lottery forms, but it is also used in multiple choice examination papers (each box corresponds to an alternative answer) and to school enrollment registers.

Although OMR can be an extremely quick way of entering large amounts of data, the input forms necessarily limit the range of permissible responses. Errors made when filling in the input forms will lead to either the data being ignored or rejected.

### Questions

1. Using an example in each case, describe five methods of data entry other than by using a keyboard. 3. What is meant by a 'data logger'? and describe a situation where one would be useful.

## Keywords

MICR OMR OCR

### **Data Entry 2 - Sensors and Data Loggers**

#### Bullets

- Dataloggers use sensors to gather their data
- Sensors may collect digital or analogue data
- Control systems employ feedback
- Dataloggers can record continuously in remote or inhospitable places without human intervention.
- Data can be transmitted or stored for download to computer later.

#### Text

SENSORS are devices which read changes in the environment around them. Data can be collected automatically in either digital or analogue form (if analogue will need conversion into a digital coded form for computer use). Sensors are often used in control systems employing feedback - sensors measuring the temperature of a room can trigger a control system which adjusts the heating. Another example is an automatic weather station, particularly in a remote or inhospitable place, where sensors can capture data relating to temperature, wind speed and humidity etc. Burglar alarms use Passive Infra-red motion (PIR) sensors, also known as movement sensors.

Sensors are a necessary part of any control system. They allow data to be collected with little human effort, and can be used for data logging to collect data remotely. However, they are limited in the type of data they can collect and can 'misread' environmental changes (e.g. a car alarm activated by a sudden gust of wind).

DATALOGGERS are like small computers, usually with a key-pad for input. Sensors connected to them can be set to record data remotely (without the need for a human to be there) and store it until accessed (down-loaded) later by connection to a computer. The electricity companies often use Hand Held Data Loggers to store meter readings as their employees go from house to house reading meters.

#### Questions

1. Explain, using different sensors as examples, the difference between analogue and digital data. 2. Explain how a room heater and a thermostat use 'feedback' to keep the temperature of the room steady. 3. A burglar alarm using Passive Infra-red motion sensors (PIRs) may be set off by the movement of a family pet. Suggest TWO ways (other than removing the pet) in which false alarms may be avoided. 4. Using a named example, describe the advantages and disadvantages of collecting data with a datalogger.

## Keywords

Sensors PIR Dataloggers

### **Data Entry 3 - Touch Screens/ Voice Recognition**

#### Bullets

- Touch screens user-friendly but limited in range of values.
- Voice Recognition turns speech into text but problem of language recognition.
- Touch tone telephones for telephone banking
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- 
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#### Text

TOUCH SCREENS are often used by museums and galleries to communicate information and also in places where customers need to place orders, e.g. fast food outlets. Values are associated with different positions on a VDU via a 'grid' of infrared beams across the front of the screen. When the user touches a particular part of the screen, the associated value is sent to be processed. Although they are very user-friendly, they are limited because only a limited number of values can be displayed at any one time.

VOICE RECOGNITION SYSTEMS capture data either via a microphone or indirectly through an audio tape. The inputted sound data is matched against a library of stored sounds and the corresponding values sent for processing. Users can dictate directly into the computer and the resulting text can be edited using word-processing software. This is much faster than typing the text in. Voice Recognition is also used in control systems e.g. to control industrial robots, and in security systems. There is a problem in that human speech can be ambiguous – many words have similar sounds but different meanings – and software cannot, as yet, interpret meaning. Also, because of different regional accents, the software has to be 'trained' to recognise the individual users' voice patterns, and this can take a long time.

TOUCH TONE TELEPHONES are being used increasingly for limited data capture via the telephone handset. A good example of this is in banking: the user enters account number and security data using the keys on the handset and then, in response to voice commands chooses the various transaction options by pressing the appropriate keys.

#### Questions

1. Argos, the retail superstore, has recently introduced a system of touch-screens into their shops whereby customers can check on the availability of goods and pay for them directly by inputting product reference numbers and their own credit or debit card details. All they then have to do is go to the collection point to collect the items. Describe what advantages this has for a) the customer and b) the store. 2. Voice Recognition Systems have not yet lived up to expectations. Using a named example, give reasons why this is so. 3. It is now possible to send readings from your electricity meter to the electricity company by using a Touch-Tone telephone. The electricity company is then able to calculate how much electricity has been used since the last reading and to send you the bill. State TWO items of data that would need to be typed into the telephone, and why the system might be prone to errors.

#### Keywords

Touch screen Touch tone telephone

#### **Data Entry 4 - Keyboard**

#### Bullets

- Translates key selections to digital text or number values
- DDE (Direct Data Entry) is time consuming and may lead to RSI
- Transcription errors may occur

#### Text

THE KEYBOARD translates key selections into digital-format text or number values. It is used to input text directly into the computer, to send instructions to computer-based control systems and to enter data captured previously on paper. This system of Direct Data Entry (DDE) is still the most common method but transcription errors are common, data entry is time-consuming and repetitive strain injuries (RSI) can result.

#### Questions

1. Describe the advantages and disadvantages of using a keyboard for data entry.

#### Keywords

Direct Data Entry (DDE) Repetitive Strain Injury (RSI)

#### **STOCK CONTROL SYSTEMS**

#### Bullets

- Each item scanned at EPOS is removed from database until minimum stock level is reached - new stock ordered from warehouse automatically.
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#### Text

#### **AUTOMATIC STOCK CONTROL**

Supermarkets with EPOS and barcode scanning systems are able to control their stock automatically. Computers in shops and warehouses are linked via a wide area network (WAN). When an item in the shop falls below a pre-set minimum stock level, the computer automatically sends a message to the warehouse warning it that more stock is required. The warehouse computer will produce a 'picking list' of the items to be dispatched and in some warehouses

even the 'picking' is done by computer-controlled fork-lift trucks.

Computerised stock control allows supermarkets to reduce costs by reducing individual stock levels (less storage, less wastage) and hence stock a wider range of products. The shop can respond more quickly if there are changes in demand (although they can still be caught out by sudden changes in buying patterns and may find themselves without stock). The main disadvantage is that the ICT systems are expensive to set up and maintain and require expertise to keep them running.

#### Questions

1. Describe what is meant by a 'minimum stock level' and what part this would play in a fully automatic stock control system.

#### Keywords

EPOS Electronic Point Of Sale WAN Wide Area Network Pre-set minimum stock level 'picking list'

#### **Stock Control - Just In Time**

#### Bullets

- JIT stock control reduces levels of stock held on site to minimum, new stock arriving only just in time to prevent stock running out.
- Storage costs are reduced, wastage reduced, company can respond more quickly to market demands.
- Systems are expensive to set up and maintain.
- Risk of running out of stock if problem somewhere in chain from supplier to store.

#### Text

#### JUST IN TIME CONTROL SYSTEMS

Just in Time (JIT) stock maintenance takes advantage of a stock control information system. When the stock level of a particular item reaches its minimum stock level, only the bare minimum of extra stock is ordered from the warehouse. This is calculated to arrive 'just in time' before the stock runs out completely, thus reducing stored stock levels to an absolute minimum. An example of this is in the car manufacturing industry, where components are bolted onto cars as they move down the assembly lines. Each worker has a small pallet of his/her particular component which is refilled just in time to prevent it running out. This minimises the amount of stock kept in the factory, but only works because the speed of the assembly line (and the rate at which components are used up) is carefully calculated, along with delivery times etc. If there are disruptions to the road haulage systems, for example, the factory could run out of stock. In the car industry this would mean that the whole assembly line would have to stop, which could prove very expensive through lost production. Just in Time processing is an example of feedback.

#### Questions

1. JIT (Just in Time) stock control was once very popular in the car manufacturing industry. Describe the main features of JIT and suggest one possible reason why some manufacturers have since moved towards a more conventional automated stock control system.

#### Keywords

JIT 'just in time' feedback