

## A LEVEL INFORMATION TECHNOLOGY REVISION NOTES

### User Support

#### Methods of User Support

- A help desk
  - A dedicated telephone number/email address/electronic link
  - The user can communicate directly with a person trained in support
    - Who may be able to control the user's computer remotely
    - Who may have access to a database of problems and solutions
    - Who will talk the user through the system
- A user group
  - A formal/dedicated body of enthusiasts/end users of a particular system/software package
    - Who communicate via an electronic forum/bulletin board/series of meetings
  - The user can post their problem/query
    - Or start a thread
    - And get a response from users with the same problems

#### User Group Help

- The user group enables its members to share knowledge/exchange ideas about the ICT application
- The user group will have an online forum/bulletin board/publish e-bulletins/produce newsletters and other publications
- The employees could check posts/threads/blogs
  - To see if an answer to their problem already exists
  - Or create a new post or thread/blog
  - And receive replies/feedback from other users of the application

## Health Issues

### Health Issues from ICT

- Repetitive Strain Injury
  - Pain or numbness in muscles / nerves / tendons / ligaments
  - Caused by constant repetitive / forceful activities when using ICT equipment
    - Such as secretary using a keyboard for prolonged periods
- Minimised by
  - Using ergonomically designed devices e.g. split keyboard
  - Or taking regular breaks from using ICT equipment
- Posture / Skeletal problems
  - Back pain / disc problems / postural stress / sciatica
  - Caused by sitting for long periods in an uncomfortable / unnatural sitting position
- Minimised by
  - Using adjustable chairs / 5 wheeled chairs
- Over exposure to the EMF frequencies emitted by CRT's
  - Can lead to reduced productivity / fatigue / sleeplessness / skin problems / headaches
- Minimised by
  - Using a screen shield
- Eyestrain problems
  - Caused by an unnatural view position
    - e.g. small fonts, glaring colours
- Minimised by
  - Using an anti-glare screen

### Precautions to minimise eyestrain

- Blinking regularly
- Adjusting the screen height
- Adjusting the brightness / contrast
- Regular eye tests
- Larger monitors
- Adequate lighting conditions

### Health Problems that may affect computer users and how they can be minimised

- RSI
  - This occurs in the upper back/neck/shoulder regions/arms/elbows/wrists/hands/fingers

- Symptoms range from numbness/restricted movement to chronic pain
- Remedy
  - Take regular breaks every half hour from working at your computer
  - Regularly stretch to relax the body Use footrests, wrist rests and document holders
  - Use an ergonomically designed workstation/keyboard/chair
- Carpal tunnel syndrome
  - This occurs when a nerve is pinched/compressed in the wrist
  - The symptoms are pain, numbness, tingling/weakness in the wrist
- Remedy
  - Take regular breaks every half hour from working at your computer
  - Wear a wrist brace/splint
  - Have a cortisone injection/surgery
- Ulnar neuritis
  - This affects the back of the inside of the elbow
  - The symptoms are tingling/pain in the fingers/elbow/funny bone
- Remedy
  - Use an adjustable seat
  - Avoid putting the elbows on the desktop
  - Use a wrist support
- Backache
  - This affects the muscles in the back
  - The symptoms are mild/severe pain in the back
- Remedy
  - Maintain a natural posture while using the computer
  - Have adequate lower back support/footrests
  - Avoid sitting in the same position for extended periods
  - An ergonomically designed workstation
- Radiation damage
  - From rays from the screen
  - Which can affect the whole body
- Remedy
  - Use an anti-radiation screen

## **Video Conferencing**

### **Hardware resources required for video conferencing:**

- Video Webcam
- Microphone
- Speakers
- Monitor
- Broadband Connection
- Modem

### **Benefits of video conferencing to train users:**

- Travelling is reduced (cost/time)
- Trainees can participate from their normal work places
- Trainees throughout the country can be trained
- Reduction in costs / time / environmental impact
- Supports multimedia
- Trainees can observe what the tutor / trainer is doing
- Interactive
- Trainees can communicate directly with the trainer
- Trainees can be observed using the system
- Training sessions can be recorded and repeated later

## CASE Tools

### CASE Tools

- Automates / supports all / many project management activities
  - For the planning / monitoring / controlling of the project's schedule and cost
  - Such as identifying / assigning / sequencing tasks and resources
  - Producing CPA / PERT charts / Gantt charts
  - In electronic form
  - Can be saved / reused
  - Using templates / drawing tools
- May perform validation
- Supports electronic communication within the project team
  - E.g. via email / forums
- Improved software quality
  - CASE tools such as DFD generators provide automatic validation
    - Ensuring that validation is carried out accurately/completely
    - Reducing the risk of errors/eliminating human error
  - Code is produced automatically by a code generator
    - And should be error-free/free from human error
  - Code will be optimised
    - So it will be efficient/execute faster
  - A project management tool supports the organisation of a software project
    - Reducing the risk of the system not meeting its objectives
- Reduced development time
  - Code is produced at electronic speeds
    - Which is faster than a human programmer could
  - Code generators produce consistent/standard code
    - Which requires less testing
  - Templates such as DFD shapes can be 'dragged and dropped'/ reused
    - Without having to be drawn from scratch
  - Graphics tools such as DFD generators automatically populate the data dictionary
    - So this stage does not have to be performed by the designer/ developer
  - CASE tools produce electronic output
    - Which can be saved and re-used for other systems
  - A project management tool automates CPA/Gantt charts/timelines
    - Ensuring development will progress to schedule

## **Benefits of using a CASE tool for project management**

- Reduced development time
  - The PM CASE tool automatically performs tasks such as critical path analysis
    - Performs tasks such as CPA faster than a human
  - Standard templates / previous PM data can be re-used
- Improved quality / increased accuracy
  - The PM CASE tool automatically validates / checks processes e.g. Gantt chart production
    - Does this consistently / eliminates human error
  - The PM CASE tool provides the PM with better quality information
    - Enables the PM to make better decisions such as responding to risks / bottlenecks

## **Other types of CASE Tool**

- Graphics tool
  - Assists / automates the modeling of the system
    - By creating and maintaining DFDs, ERDs
  - Automatic validation of DFD levels / ERD relationships
  - Automatic population of the data dictionary
- Code generating tool
  - Assists / automates the production of program code / interface code
    - From formal program specifications
  - Code is optimized
- Interface generating tool
  - Assists / automates the production of code for the user interface
    - From design of IO objects (buttons / text boxes etc)
- Data dictionary generator
  - Automatically populates the DD
    - With processes / entities / attributes
  - Automatically validates the DD
  - The developer can add documentation / annotation

## User Interfaces

### Graphical User Interface (GUI)

- Not text based
- Uses windows / icons / menus / pointers
  - Pull down menus
  - Buttons
  - Scroll bars
  - Wizards
  - Mouse
  - Multimedia Elements
    - Audio / sound clips, video clips
- WYSIWYG

### Main features of a Natural Language Interface

- Allows user to interact using written or spoken language instead of computer language and commands
- Verbs or phrases used
  - To instigate functionality
  - Such as creating, selecting, modifying data
- Sounds are stored in a database
  - User input compared with these
- Speech recognition software is used

### Drawbacks of Natural Language Interfaces

- It can be difficult to implement effectively / accurately
  - Due to unpredictability of natural language
  - And ambiguity of natural language
  - Or variations in a person's voice patterns
- It can be time consuming to initialise / calibrate the system
- The user may have to keep repeating words / phrases until they are recognised
- It has to be calibrate for one user at a time / it may only work with a single user
- May not function accurately in a noisy environment
  - Commands may be misunderstood due to background sounds

### Main features of a Command Line Interface

- There is a finite list of commands
- Each command is a short word e.g. PRINT
- Each command is typed at a prompt
- Some commands have parameters or switches

## **Why an experienced user may prefer a CLI to a NLI**

- Experienced user will have memorized all the commands
  - Therefore a CLI is a very direct method / requires minimal keyboard entry
- Input to a NLI is relatively slow and can be verbose
  - Prone to error due to mispronunciations / extraneous noise

## **Touchscreen**

A touch screen is an input and output device

Menu options/help is displayed on the screen

A stylus may be provided

The screen may be covered by a membrane

... which is sensitive to pressure/heat

Or there may be a line of infrared/light/lasers/sensors

... at the corners/sides of the screen

The pressure of the user's finger is detected/the finger cuts the beams

The x position/coordinate calculated

... and y position/coordinate calculated

## **Why a touch screen interface is suitable**

- Interface does not require keyboard skills
  - Therefore can be used by members of the public / inexperienced users
- The interface is intuitive
  - Actions / menu options are chosen by pressing the appropriate icon / part of the screen
- The interface is durable
  - No moving parts e.g. keys on a keyboard
  - It can be kept clean / is hygienic
- The options for businesses can lend themselves to images
  - Which can be used as icons
- These icons can be changed dynamically
  - To accommodate users not speaking local language for example

## **GUI: Opening Applications**

- An icon or shortcut representing the application
  - Can be clicked / double clicked
- Navigate to the name of the application
  - In the menu / submenu
  - Highlight / click it
- Use a hot key / shortcut / function key
  - Combination of specific keys



- By pressing a special key

### **Purpose of a User Interface**

- To accept input from the user
- To provide output for the user

## **Human Computer Interaction**

### **Factors influencing Human Interaction with Computer Systems**

- Ergonomic factors
  - Concerns the design of
    - The general working environment
    - Input devices
    - e.g. adjustable chairs / split keyboards
  - The design of general office furniture
    - Adjustable chairs
      - Minimise the risk of back pain
  - The design of computer equipment
    - Such as split keyboards
      - Minimise the risk of RSI
- Psychological factors
  - Concerns how humans learn things
    - Human perception
    - e.g. short and long term memory / intuition
  - This includes how humans retain and recall information
    - Including long-term/short-term memory
    - And human perception
    - In which past experiences can influence how users perceive objects
  - The memory load on the user should be kept to a minimum/cognitive overload should be avoided
  - Examples: the use of short menus or icons/use of standard interfaces
    - The use of metaphors/suitable colour schemes
    - The use of colours to strengthen or weaken information such as 'green for go'
- The use of common interfaces
  - Reduces the time taken to adapt to new systems
  - Reduces the need for training
- Facilities can be provided for inexperienced users
  - GUI
    - WIMP

- o On-line / context sensitive help
- Human Perception
  - o Past experience can influence how humans perceive objects
  - o Use of metaphors colour association / sound association
  - o Example:
    - Red for danger, use of muted colours to encourage calm
- Human Memory
  - o How humans store, retain, recall information
  - o Long term memory versus short term memory
  - o Example:
    - Limit to menu depths / provision of standard interfaces

### **Interactive DVD**

- The content can include multimedia elements
  - o Such as video clips to show the user how to perform a task
  - o Sound for verbal instructions
- The content can be access in a non-sequential order
  - o The user can select different options / choose a personal path through the material

### **Ergonomic Peripherals: Keyboard Example**

- An ergonomic keyboard is specifically designed
  - o To be physically comfortable/natural to use
- An ergonomic keyboard may be split in two/have two parts at an angle
  - o With an integrated/separate/adjustable wrist or palm support
- Some ergonomic keyboards have vertically aligned keys
  - o Enabling the user to type with their hands held vertically with 'thumbs up'
- An ergonomic keyboard enables a more natural posture
  - o And requires less finger effort/reduces key reach
  - o Which can minimize fatigue/RSI/Carpal Tunnel syndrome
  - o And boost productivity

## **CAD / CAM**

### **Computer Aided Design (CAD)**

- Computer technology is used in the design of objects / shapes
- Objects can be viewed in 3D
- Techniques such as surface rendering can be applied
- An object may be rotated in three dimensions
  - Viewed from any angle
  - Viewed from different distances
- Calculations can be performed automatically
- Standard objects shapes / templates can be used
- Designs can be reused / edited

### **Computer Aided Manufacture (CAM)**

- Specialised computers are used to control and monitor tools / machinery in manufacturing
- The steps in the manufacturing process are built into a program
- The program may be the output from a CAD stage
- A computer can control a series of robots
  - Moving the product from machine to machine
  - As each stage in the manufacturing process is completed
- CNC technology can be used
  - e.g. to control lathes
- Some CAM systems can automate tasks such as parts ordering / scheduling / tool replacement

## Software / System Development

### Prototype Developing

- A first cut / non-functional model is created
  - Evaluated by the user
  - User provides feedback
  - Feedback goes to the analyst / developer
  - An improved / refined model can be created
- The prototype may evolve in the final system / evolutionary prototyping
- The prototype may be discarded when the system objectives have been established / throwaway prototyping

### Prototyping

- A first-cut solution/model is developed
- This may be a non-functioning front end/dummy user interface
- This is evaluated by the user
  - Who provides feedback to the developer
- The model is repeatedly refined and evaluated
- The user interface is modified
- Functionality is added
- There are two types - evolutionary and throwaway
- The iteration stops when the user is satisfied with the system
  - i.e. evolutionary prototyping
  - Or when the user requirements have been established
  - And the system can then be developed using the waterfall method
  - i.e. throwaway prototyping

### Waterfall Model

- There is a sequence of distinct stages
  - Example:
    - Analysis
    - Design
    - Testing
    - Evaluation
  - One stage must be completed before next stage commences
  - Deliverables are produced at the end of each stage
  - Example:
    - System specification at the end of the analysis stage
  - If an error is found during one stage
    - A previous stage may have to be reworked

## **End User Involvement during the Waterfall Model**

- The users will be involved in acceptance testing
  - Where they use the system in a realistic environment
  - Using real data / volumes of data
  - To ensure the system meets its objectives
  - By providing feedback to the developers
- The user will be involved in the system review / maintenance
  - When the system has been in use for a short time
  - By providing feedback to the developers
  - About errors discovered
  - And enhancements required

## **Rapid Application Development (RAD)**

- An iterative development process (continuous/cyclical)
- A preliminary data model is developed
  - And a prototype/user interface developed
  - Providing the business processing/functionality
- The prototype helps the analyst and users to verify the requirements
  - And to refine the data model
  - And implement the required processing
- There are strict deadlines set for each refinement
- User requirements/system functionality are prioritised/categorized
  - As essential/non essential
- Formal workshops are scheduled between the developer and users
- The JAD methodology is often used
- CASE tools are usually used

## **Software Maintenance**

- Perfective maintenance
  - The system is working correctly
  - Improvements are implemented
    - Such as reduced access times / greater accuracy
- Adaptive maintenance
  - Additional functionality is added
    - Such as new user requirements
    - Or requirements required by external factors such as new legislation
- Corrective maintenance

## **Fact Finding Methods during Analysis**

- Observation
  - The users of the system are observed as they carry out their daily tasks
- Interview
  - The users respond to spoken questions on a one-to-one basis
  - The interview may be structured or unstructured
- Document Inspection
  - Samples of orders / invoices / reports are examined
    - To identify inputs and outputs
- Questionnaire
  - Users complete a set of pre-determined questions
    - Which may be open or closed

## **Technical Document Usage**

- The technical descriptions of the system
  - Such as user requirements / system specification / DFDs / ERDs / module specifications / code listings / data dictionary
  - Will be used to identify errors / enhancements
    - Modified as necessary
- The test plan / test data
  - Will be used to retest the system
- To check that errors have been corrected / changes work as expected

## **Sections in User Documentation**

- Help / FAQs / Tutorials
- Installation instructions
- HW & SW configuration
- User guide / instructions

## **Contents of a typical User Guide**

- Main Contents
  - The purpose of the system
  - Contains the system objectives
  - Describes the functions provided by the system
- The system configuration
  - Specifies the minimum:
    - Hardware required
    - Software required
- Installation guide
  - Implementation instructions
  - Describes how to install the software
    - As well as load / create initial data files

- Operating instructions
  - Describes how to operate / navigate through the system
    - Using step by step examples / screenshots
      - For example, printing a report
- Trouble shooting / help section
  - Describes common problems and how to fix them
    - Using FAQs as an example

### **Advantages of using an on-line user guide rather than a hard copy**

- It can incorporate multimedia elements such as video clips/sound clips/ hyperlinks
- It can be interactive/the user can use hyper links to navigate through the guide
- It can be context sensitive/provide help on what the user is currently doing
- It can provide a search facility/search engine/the user can search for specific topics by name/key words
- As it is electronic, it can be kept up to date more effectively by updating a master copy
- Multiple users can access a single copy of the on-line guide
- Greater accessibility – the user can adjust screen or text sizes/zoom in and out

### **Obtaining New Software**

- Off the shelf
  - Purchase standard software off the shelf from a computer store / online retailer
    - Standard packages available
- In house
  - Develop the software in-house using software specialists / software department
    - Some companies may not have required expertise
- Outsourcing
  - Outsource the development of the software to a third party
  - Software development company
    - Companies can have specialist software designed specifically for their needs

### **Unit Testing**

- Test data
  - Normal data
    - Lies within the permissible range
      - E.g. 2 for a month number
  - Extreme data
    - Lies on the boundary

- E.g. 12 for a month number
- Erroneous data
  - Should not normally occur
  - E.g. 13 for a month number

### **Acceptance Testing**

- Performed when the software is ready to be released / handed over to the client / users / after application testing
- Intended to give the end users the confidence that the software meets their requirements
- A group representing the end users test the application
  - Using real world scenarios / data
- The users report back / provide feedback on any problems
- Eventually, users sign off the software / complete the contract

### **Alpha Testing**

- Performed by the developer
- The system is tested against the system / module specifications
- Includes module testing / integration testing / system testing
- Test schedule / plan produced
- Test data is used

### **Beta Testing**

- Performed after alpha testing
- System given to selected groups of potential users
- Known as pre-releasing testing
  - For use in a realistic environment
    - With real data / real volumes of data
- The users evaluate the system
  - Provide feedback to the developer



## **Associations and Societies**

### **Benefits of joining the Association for Computing Machinery (ACM)**

- Membership of the world's largest educational and scientific society
  - Specifically for computing professionals
- Access to a wide range of resources
  - Publications/on-line books/searchable digital library/newsletters
- Access to special interest groups
  - Attending conferences/accessing specialist publications/activities
- Access to professional development courses
  - And career advice
- Contact with online forum groups
  - Communicating with fellow professionals throughout the world

### **Benefits of joining the Association for Computing Machinery (ACM)**

- Members have access to the world's largest digital library
  - Of computer/ICT literature, publications, online books, journals
- The ACM enables members to contact fellow members
  - Via newsletters/at conferences/seminars/courses/special interest groups
- The ACM provides career guidance/a Career and Job Centre section
  - Which is an electronic meeting place for job seekers and employers in the computing/IT industry
- They provide online courses
  - Enabling members to keep abreast of the latest development in ICT
- They provide accreditation for qualifications/courses

### **British Computer Society (BCS)**

- Role of the BCS
  - The Chartered Institute for IT / represents IT & Computing specialists / the IT sector
  - Promotes wider social, economic progress through the advancement of IT science and practice
  - Brings together industry, academics, practitioners, government
    - To share knowledge
    - Promote new thinking
    - Inform the design of new curricula
    - Shape public policy
    - Inform the public
- Professional Advantages
  - Contact with other IT professionals

- Over 70,000 members (practitioners, businesses, academics, students) in the UK and worldwide
- o Delivers a range of professional development tools for practitioners
- o Offers a range of widely recognised professional and end-user qualifications
  - For beginners
  - Home users
  - Professionals
- o Validates a range of qualifications
- o Members can keep up to date with developments in IT
- o Members can avail of up to date training in IT tools / techniques / CASE tools

## **Audit Trails**

### **Audit Trail Activities**

- The terminal where each user is logged on
- The identity of logged on users
- The resources accessed by each user
- The number of unsuccessful attempts at logging on to an account
- The time during which user is logged on

### **Audit Software**

- Audit trail / log can help identify who was responsible
  - For unauthorised modification of software for example
- Records who was logged on / username / IP address
  - At which stations
  - The log on / off times
  - All access to data files / read / write options

## Networks & Data

### Data Consistency

- A particular attribute has only one value at a particular time / throughout the database
- A change to a data value is implemented throughout the database
  - Because it is held in only one table

### Data Integrity

- Refers to the validity / correctness / accuracy of data
  - Which can be affected by input errors
  - And processing errors
- Minimised by data verification / validation

### Data Inconsistency

- An attribute / field stored more than once does not have the same value throughout

### Data Redundancy

- Non-key data
  - Stored more than once in the database
    - E.g. titles of projects / names of clients / programmes
  - This increases the memory needed to hold the database
    - Increases data retrieval times
    - Impacts on data integrity / data consistency

### Data Independence

- Data is kept separate
  - From programs / software which use / processes it

### Flat file

A database system in which each database contains a single file . . . which is not linked to any other file.

### How data can be stored on a network and kept secure

- The use of User IDs and passwords
  - Each authorized user is allocated a unique User ID
    - And a default password
    - Which the user can change
  - A valid User ID and password are required to log to on

- The use of access rights / levels
  - Each user of the network is allocated specific rights to data files
  - Examples include read only / read and write
  - The access levels are maintained in an electronic table
  - Automatically checked when a user tries to access a data file
- Use a firewall
  - This monitors traffic into the network
  - Traffic must comply with the security policy
  - Different levels of security can be set
  - If the policy is not met, access is denied

### **How data can be transmitted on a network and kept secure**

- Data encryption
  - Data is coded before transmission
    - Using a special algorithm / key
  - On receipt data is decoded
    - Using the same algorithm / key
  - Intercepted data is meaningless without the key

### **Anti-Virus Software**

- It automatically
  - Checks / scans all transmitted files / programs / software
    - Coming into the network
  - Via email / attachments / the Internet / portable devices
  - Against a database
  - Of known viruses / signatures
  - Which is updates to keep track of new viruses
  - Blocks / deletes anything identified as malicious to data
    - E.g. spyware
  - Disinfects files / remove viruses from files
- Suspicious software may be quarantined / run in isolation
- A report detailing identified viruses is produced

### **Firewall**

- Monitors / checks / analyses / filters all traffic / data / communication
  - Entering the network
  - Or leaving the network
- Blocks / denies any messages
  - Which does not meet specified criteria / security policy / settings / rules
- Will permit access to legitimate communications
- It may be part of a proxy server

A report detailing unauthorised attempts is produced

## **Data Encryption**

- Data is transferred
  - By the application of a key
  - Before data transmission
- On receipt the data is decrypted
  - Using the appropriate decryption key
- Intercepted data is meaningless without the key

## **Internet Data Security Threats**

- Attack from viruses / spyware
  - Attached to emails or other files / from infected sites / from non-secure sites
  - Leading to data loss / modification
- Unauthorised external access
  - From programmers / hackers
  - Leading to unauthorised use of data / fraudulent use of data / corruption of data / deletion of files

## **Client Server Network**

- At least one controlling / dedicated / host server
  - Which is a high capacity / high speed computer with a large hard disk capacity
  - Which serves / handles requests
  - From many clients / the other nodes on the network / clients initiate requests
    - For resources / services
    - Such as data / files / software / email / web access / storage / peripherals
- The server provides communication links / controls access / security
- A client is a 'dumb' terminal

## **Peer-to-Peer Network**

- There is no server / controlling computer
- All nodes / computers are of equal status
- Nodes are both suppliers and consumers of resources
- Each node makes of its resources available to the other nodes
- A node can request a resource that it needs
- Resources include processing time, data storage, disk storage, bandwidth, and printers
- Each node is in charge of its own security / administration
  - Decided which other nodes get access to its resources

## **Disadvantages of a peer-to-peer network**

Low level of security  
... as security cannot be controlled centrally

### **Advantages of a peer-to-peer network**

Low installation costs  
... as there is no need to resource a dedicated server.  
No need for a sophisticated operating system

### **Advantages of Networks**

- Software can be shared
- Hardware can be shared
- Communication between users is possible.
- Users are not restricted to a specific computer
- Security can be controlled centrally

### **Wireless LAN**

- This connects computers together within a small geographical area
- All network computers/stations/devices are wireless enabled
  - Equipped with wireless network interface cards (WNIC)/dongle
- Access points act as base stations/hubs for the wireless network
  - Which transmit and receive radio signals for stations to communicate with
- Wireless devices can be laptops, PDAs, IP phones or fixed desktops / workstations

### **Benefits of Wireless Communication**

- Devices do not have to be physically connected together
  - ...so devices can connect to the network anywhere there is a signal
- Additional devices can be connected to the network
  - ...using a wireless card/portable devices such as notebooks can be added

### **Drawbacks of Wireless Communication**

- Security can be a risk
  - ...unless access to the network is password protected

### **Parity Checking**

- An extra bit is added to a group of bits / byte / block of data
  - Making the number of 1s odd or even
- The bit is transmitted as part of data

- The parity is checked on receipt
- If the data's parity bit is incorrect
  - An error has occurred / a bit or bits have 'flipped'
- Only an odd number of 'flips' will be detected
- Error Correction:
  - With simple parity checking, it cannot determine which bits have flipped
    - The data will have to be re-transmitted
  - With latitudinal and longitudinal parity checks / block parity checks
    - If one bit is transmitted incorrectly the error can be located and corrected

### **Checksum**

- Calculated by adding together all the bytes / applying an algorithm
  - In / to a block of data
  - Or 256 bytes for example
  - Before transmission
- The checksum is recalculated
  - After data transmission
- If the checksum is incorrect, the data is very likely to be an error
- Some types of checksum may automatically correct the error

### **Echo Checking**

- The receiving device sends the received data
  - Back to the transmitting device
- The transmitting device can compare this data with the original
  - And make corrections as appropriate / retransmit the data

### **Communication Standards**

- To enable different hardware devices / computers / software / information systems
  - To pass data / messages to one another coherently / securely / compatibly
  - Using agreed formats / rules / error handling / speeds

### **Open Systems Interconnection (OSI)**

- Developed as part of the Open Systems Interconnection initiative
  - By the International Organization for Standardization (ISO)/ANSI
- The OSI model consists of an abstract / basic model of networking
  - A set of specific protocols
- It defines a layered protocol / there are seven layers



- Each later deals with specific functionality / each later is independent of the others
- Control is passed from one layer to the next
- Each layer interacts directly only with the later immediately beneath it
  - Provides facilities for use by the layer above it
- P D N T S P A

## JPEG

It uses image compression

... to reduce the file size/memory size

... at the possible expense of image quality/lossy compression

The degree of 'lossiness' can be varied

## A Prompt

- A prompt is a message / hint / place marker / indicates the point or purpose of inputs / is produced by the computer
  - For example, C:\> the current directory or path

## A Parameter

- Refers to additional / qualifying information required for a command
  - For example, wordpro.exe the name of the program to be executed

## Access Rights

- Each user / group is allocated an access level
  - Controls the access they have to specific data files
- Example: Read Only
- Access rights to a data file are held in a table
- Enforced by username / password system
- When a user tries to access a data file, the computer uses the table
  - Checks that they have appropriate level of access
    - If they do not, access is denied
- Authorised Users
  - Access rights to data files
    - Will be recorded in an access table
- When a user attempts to modify data
  - The user's access rights will be checked in the access table
  - To ensure they have EDIT / MODIFY / DELETE access
  - Only if the user has appropriate rights will the modification be permitted

## DVD-R

- Sufficient capacity to store a typical business application
  - E.g. 4.38gb

- Data can only be written to it once so its contents cannot be accidentally erased / altered
- It is light in weight so it incurs minimal postage costs

## Acceptable Use Policy

### Acceptable Use Policy

- How user accounts should be used
  - Selecting secure passwords
  - Regular changing of passwords
  - Keeping passwords secure
  - Not using another user's password
  - Logging off at the end of a session
  
- How users should access data
  - What access is permitted and how that data can be used
  - What access is restricted
  - What a user should do if he / she accidentally accesses data which he / she is not permitted to access
  
- How users can access the Internet / email
  - What access is permitted / what types of websites may be visited / what email use is permitted
  - What access is prohibited / what types of websites are prohibited / what email use is prohibited
  - Time restrictions on the use of the Internet
  
- How the policy will be enforced
  - The disciplinary process
  - Penalties / sanctions
  - Appeal procedures
  
- Rationale for the policy
- Defines the employer's rights / the employee's responsibilities regarding the use of ICT
  - Including proper use of e-mail and the Internet / how e-mail and the Internet should be used for business and personal use
  - And how the use of ICT such as e-mail and the Internet will be monitored and policed
  
- It will describe security procedures
  - Such as secure logging on and off
- It will prohibit actions which will compromise data security
  - E.g. the use of storage devices not checked for viruses
- It will identify management and employee's responsibilities relating to legislations
- It will define the disciplinary process / appeals process
  - Penalties for non-compliance

## Backup

### Backup and Recovery

- Data should be backed up when processes are run / weekly / monthly
- Data should be backed up after installation
- Backup data should be copied to a portable medium
  - Such as a CD / DVD / external hard drive
  - Stored away from the computer system
- Incremental backup
  - Backing up only the data that has been changed / modified
    - Quicker than a full backup
    - Potential to miss files, leading to incomplete backup
- Full backup
  - Backing up all of the data
    - Takes time
    - Ensures all files are backed up

### Backup and Recovery suitable for Batch Processing

- Backup
  - A complete backup would be suitable
    - All data files are backed up
  - An incremental backup is suitable
    - Only data has changed is backed up
  - Master data should be copied
    - Just before the batch processing takes place
    - Onto a portable medium
    - Stored away from the computer system
  - Transcriptions in batch should also be copied
- Recovery
  - The master data should be restored from the backup copy
  - The batch of transactions should be processed again

### Suitable Backup and Recovery Strategy for Real Time Processing

- A RAID is often used
  - An exact copy
    - Called a mirror image
    - Of all data / transactions is kept
  - All transactions are recorded on both systems simultaneously
  - The copy is stored at a remote / secure / separate location
- If the live system fail
  - There is instant switch over
  - To the back up

## Disaster Recovery Plan

- To ensure the organisation can continue operating
  - After a disaster / disruption
    - Such as flooding / earthquakes
- To ensure critical data has been identified
- An alternative location may be established
  - Where the computer system can operating until the threat / damage is over
- To ensure that key personnel have been identified
  - Will continue to have access to the organisations computer systems

## ICT in Business

### How the introduction of ICT has affected employees in businesses

- Some workers have been made redundant
  - Robots can work more efficiently than humans
- The work of many employees has been made safer
  - Robots can operate in hazardous conditions e.g. paint spraying booths
- The work for many employees has been made less physical
  - Robots can be used to maneuver heavy components
- Some workers may be de-skilled / re-deployed
  - ICT systems can do their jobs more effectively

### Quality

Robots can be programmed

... to perform tasks very accurately/consistently

Robots can perform very intricate operations

... and work in hazardous conditions

Humans may be inconsistent due to distractions/personal issues

### Financial Implications

There is a very high initial investment

... due to hardware and software costs

Using robots instead of humans will be to a reduced wages bill as fewer employees are needed to assemble cars

... as robots can perform most of the tasks performed by humans

However, the financial benefit will occur over the longer term

### How ICT can be used to help train employees

- An-line training course / Interactive DVD
  - Can incorporate multimedia elements
    - Which the users could use at their own pace
- Videoconference
  - Can be used simultaneously to train a number of users
    - At a number of geographically dispersed locations
    - Allows interaction between trainer and trainee
- On-line course / tutorial
  - Employees log on and complete the course individually

### On-Line Training

- Course is delivered over the Internet / an intranet
  - Interactive course
- Each participants logs on
  - At a time convenient to them

- Sets their own pace
    - Can repeat / review previous sections / jump ahead of sections
  - The course content is presented using multimedia / video / audio / graphics
  - Context sensitive help may be provided
  - Participants may communicate with the instructor via email / forum / user groups
  - Information may be disseminated to participants via bulletin boards
  - User navigates through the course using simple controls
    - E.g. Next / Back buttons
    - Interactive index
  - Different navigation paths may be provided for different categories of users
- The progress of the trainees can be monitored electronically

### **Benefits of Offshoring Call Centers etc**

- Reduced wage costs
  - Standard of living in places like India is much lower than somewhere like the USA
- Effective use of international time zones
  - Help desk can be manned at night in the USA by employees in India for example working during their day
- The business can focus on its core business
  - Use the services of a specialised provider of help desk facilities

### **Benefits of using ICT to utilise Teleworking**

- Less / no time spent travelling to work
  - This time can be used more productively
  - This leads to reduced petrol costs / bus fares / train fares
- Location is irrelevant
  - Employees can access the companies ICT systems using the Internet / an intranet
- A better work-life balance / more flexible working hours
  - Parents can combine working with childcare
  - People with health problem (e.g. physical immobility) do not need to leave their homes

### **Benefits of using the Internet to sell goods**

- Increased potential market
  - The Internet is a global network
  - Search engines can direct Internet users to their website
- Increased hours of business
  - The Internet is active 24/7
- Better communication with customers

- e.g. mail-shots, email, reviews
- The company can sell e-books for example
  - Download to e-reader

### **Why a real shop may be preferred**

- Some customers prefer to browse through actual items
  - Sample them before purchasing
- Customers can speak directly to employees
  - Ask for advice / suggestions
- There is a perceived increased risk of identity fraud on the Internet

### **Advertising ICT Products: Website**

- Website can contain multimedia components
  - E.g. animations / sounds
  - Whereas a magazine for examples is restricted to text / graphics / static
  - Website could include demo
- Potential audience is worldwide / not restricted to a magazines readership for example
  - Any internet user could be directed to the site via a search engine
  - Website is available 24/7
- Website could include email link
  - Company could aim to build up a database of potential users
  - Contact them with promotions

### **How ICT has affected shopping / banking**

- Online / cashless shopping
  - Customers can purchase goods (on the Internet / in stores) using credit / debit cards
  - Increased risk of fraud / wider choice / no need to carry cash 24/7
- Online banking
  - Customers can check balances / transfer funds / set up DDs and SOs
  - Increased risk of fraud / identity theft / 24/7

### **Methods of obtaining software**

- The software could be purchased ready made
  - Off the Shelf
  - From a computer store / specialist software shop
- The software could be developed "in-house"
  - By specialists within the business
- The software could be "out-sourced"
  - To specialist software developers



### **Advantages of Off-the-Shelf software over a custom built / bespoke package**

- It is immediately available for use
- The cost will be shared among many users
- It should be fully tested/should contain few errors
- There should be support available from other users, e.g. via user groups
- Training materials should be already available

### **Impact of ICT on employees working from home / Teleworking**

- Advances in telecommunications
  - Such as broadband
  - Enable employees to access their organisation's database
  - And software / applications
  - Using the Internet
  - Usually via an intranet
  - Irrespective of location
  - So they can work as effectively from home / do the same work at home
- Employees can communicate with managers / colleagues
  - Using electronic bulletin boards / emails
  - Or using webcams / videoconferencing

### **Teleworking: Drawbacks**

- Less management control of the employees
  - Most contact will be indirect
  - Employees cannot be observed directly
  - There may be a lack of teamwork
- The company must provide appropriate ICT resources
  - Such as a broadband connection / intranet
  - Access to databases / software via Internet

## Processing

### Benefits of using Real Time Processing

- No risk of recordings “clashing”
  - As record locking can be used to prevent the same record being updates by two users at the same time
- There is instant / immediate feedback
  - Informing the user that the process has been carried out e.g. a reservation

## Normalisation

### Normalization

- 1NF
  - Remove repeating groups
- 2NF
  - Remove fields not dependent on the whole primary key / Remove non-key dependencies
- 3NF
  - Remove fields (other than candidate keys) that depend on other non-key fields

## Mobile Phone Technology

### Mobile Phone Technology

- SIM Cards
  - A mobile phone contains a Subscriber Identity Module
    - A smart card that gives the user access to a range of subscriber services
  - The SIM card identified the subscriber to the network system
- The Network
  - The country is divided into overlapping cells
    - Each uses a different set of radio frequencies
  - At the center of each cell is a base station
    - Connected to an antenna (mobile phone mast) which communicates with all of the mobile phones in the cell
  - A group of base stations is connected to a mobile telephone switching center
    - Which will be connected to a second level MTSO, and so on
  - These switching offices are connected to the Public Telephone System
  - General Packet Radio Service (GPRS) / 3G protocols support mobile data streaming and transfer
- Mobility
  - Each mobile phone is controlled by the base station for the cell it is currently in
  - When the phone is about to leave the cell, the base station detects that the received signal strength is fading
    - It asks the surrounding base stations to report the power levels they are receiving from the phone
  - Control is transferred to the cell whose base station is receiving the strongest signal
  - A message is sent to the phone informing it that it will be under the control of a different base station
    - It must switch to a new frequency

### Mobile Phone Network

- Radio frequency waves are used for communication information
- When a mobile phone connects to a network it communicates with the nearest base station
- The area covered by a base station is known as a cell
- Each cell is usually split into three sectors
  - Which overlap with the sectors of neighbouring cells
  - To create an uninterrupted network
- When people travel, the signal is passed from one base station to the next
  - And usually never has to travel further than the nearest base station

- Cells are connected to cellular telephone exchange switches
  - Which are connected to the public telephone network /other exchange switches

## ICT Laws

### ICT Laws

- Copyright, Designs and Patents Act
  - Applies the concept of intellectual property/ownership to software
  - A license is required for copyrighted software
  - It is illegal to copy unlicensed software  
It is illegal to distribute unlicensed software
- Computer Misuse Act
  - It is illegal to access computer material without permission
  - Or to access materials with intent to commit or facilitate a crime
  - Or to modify materials without permission

### Main Implications of Data Protection legislation

- Organisation
  - Data users must register
    - Must comply with the DPA's 8 principles
  - Must appoint a DP officer
  - Must identify what data will be stored
    - And the purpose for which it is being processed / the processing performed
  - Relevant staff must be informed and trained
  - Procedures must be set in place to ensure compliance
  - Example:
    - The data user must implement good information practice specifying how data is kept secure / up to date
- Members of the public
  - These are the data subjects
  - Confidence that data held about them is accurate / up to date
  - Data subject have the right to see the data held about them
    - And have any errors corrected
  - There are cost implications – a fee can be charged
  - Compensation may be available if their rights are contravened

### Software Piracy

- The illegal distribution and / or reproduction of software which can result in serious loss of revenue
- Number of steps to make piracy more difficult
  - Software could be distributed in encrypted form
  - Each copy requires a unique key or code before it can be installed
  - When this key is used to install the software it locks the software so it cannot be installed on other computers

- Hardware key or dongle can be used to the same effect
- Special software can be used to prevent a disk from being copied
- Companies could consider Digital Rights Management issues
- Automatic key generation software is widely available
  - As is disk cloning software
    - Easily rendering many methods useless allowing piracy
- Legislation
  - Piracy is punishable by law, whether deliberate or not
  - Software will be covered by the Copyright, Designs and Patents Act
    - Applies the concept of intellectual property / ownership to software
      - Within the UK
  - The Act states that “an article is an infringing copy if its making constituted an infringement of the copyright in the work in question”
  - A licence will be required for the computer game
  - It will be illegal for anyone to copy the game without the companies permission / if not covered by a site / multiple user licence
  - It will be illegal for anyone to distribute the software without the companies permission / an appropriate licence
  - The penalties for breaking this Act include a term in prison and an unlimited fine
  - Legislation is difficult to enforce
  - Will be on the company to detect and prosecute offenders
  - Support is available from the Federation Against Copyright Theft (FACT)
    - Acts against counterfeiting, copyright and trademark infringements

## **Management Information System**

### **Management Information System (MIS)**

- A MIS transforms large amounts of (raw) data
  - From a data processing system/using transaction data
  - Into useful information
  - Which is necessary for a business to be managed effectively/ achieve its goals
  - Which is used by different levels of management
- It utilizes data from many sources
  - Including internal and external sources
- Appropriate queries and reports are generated
  - For routine and non-routine purposes



## Decision Support System

### Decision Support System

- It assists managers in solving complex business problems
  - By applying different business models to data
- The problems may be ad hoc/complex
  - Or unstructured/semi-structured problems
    - Such as 'what if'/using goal seeking/risk analysis
  - Assists organisations with strategic/tactical/operational decision making
- It may incorporate an expert system

### Decision Support System

- Assists managers in solving complex business problems
- Applies various business models to data
- The problems may be ad hoc / complex
  - Or unstructured / semi-structured problems
- 'What-if' analysis can be performed
- Goal seeking
- Risk analysis may be used
- Assists organisations with strategic / tactical / operational decision making

## Databases

### Database Administrator

- Defining/maintaining/modifying
  - The database structure
  - Tables/attributes/keys/relationships/schema/data dictionary
- Controlling access to the database
  - E.g. assigning access rights/allocating user names & passwords/creating 'user views'
- Designing/modifying standard queries/reports/macros
- Identifying new user query and report requirements/liasing with users
- Keeping users informed of changes relevant to the user e.g. additional reports Managing on-going user training
- Managing/monitoring back ups
- Ensuring compliance with legislation e.g. the DPA

### Databases

- Centralised Database
  - Single copy of the database held at a central location
  - Information such as prices will be updated directly
  - Any data amendments (e.g. stock levels)
    - Will be generated at branch level
    - Communicated to the centralised database
    - And the database updated
  - Data Consistency
    - Ensured as there is only a single copy of the database
  - User access to data
    - All users access the single copy of the data so access times are greater due to distances involved
    - The volumes of access at the central location will be high and there may be a deterioration in performance
    - If the central location fails, the entire database fails
  - Data Security
    - Simpler to enforce centralised security measures on a single copy of the database
    - The increased volume of data traffic may be more vulnerable to interception

- Distributed Database
  - Relevant copies of part of the database will be held at each location
    - As that is where it will be most frequently accessed
  - Data amendments will be implemented in the database at the appropriate location
  - The scattered versions of the database must be synchronised
    - Ensuring they all have consistent data
  - Each location gets a daily copy of data
  
  - Data Consistency
    - There may be multiple values of the same data in different locations
    - A field may be updated at one location only
    - A field may be updated to different values at two different locations
    - The data has to be reconciled at regular intervals
  - User access to data
    - Users have faster access to their local data as the data is stored locally
    - Volumes of access at each location will be reduced
    - If one location fails, only that part of the database is affected
  - Data Security
    - It is more complicated to enforce uniform security measures across a number of locations
    - It is simpler to enforce security measures at a single location
    - The decreased volume of data traffic will be less vulnerable to interception

## Expert System

### Expert System

- A user interface
  - The user keys in facts to the expert system about the problem
    - Receives a solution and reason / explanation
- A knowledge / rule base
  - Contains information / heuristics, rules about the problem domain / expert knowledge
  - Represents the knowledge of human experts
- An inference engine / mechanism
  - Applies the rules using the user's input
    - Draws conclusion
  - Can apply fuzzy logic

### Expert System

- Rule Base
  - Contains knowledge / heuristics / connections / facts
    - About the problem domain
  - Derived from human experts
- Inference engine
  - Applies the rules
    - Using the user's input
    - Draws conclusions
  - Fuzzy logic may be used
- Expert system can apply the knowledge of a number of very experienced users from a certain industry
- Can produce very accurate diagnoses
  - Up to date diagnoses
  - Consistently
  - Provide reasoning / probabilities
- Cannot replace human intuition
  - E.g. where a user may sense or guess a problem
- Humans can learn from their mistakes
- Risk of over reliance on technology
- Users may become deskilled