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 lightning 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
On-line / context sensitive help

- Human Perception
  - Past experience can influence how humans perceive objects
  - Use of metaphors colour association / sound association
  - Example:
    - Red for danger, use of muted colours to encourage calm

- Human Memory
  - How humans store, retain, recall information
  - Long term memory versus short term memory
  - Example:
    - Limit to menu depths / provision of standard interfaces

Interactive DVD

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

Ergonomic Peripherals: Keyboard Example

- An ergonomic keyboard is specifically designed
  - To be physically comfortable/natural to use
- An ergonomic keyboard may be split in two/have two parts at an angle
  - With an integrated/separate/adjustable wrist or palm support
- Some ergonomic keyboards have vertically aligned keys
  - Enabling the user to type with their hands held vertically with ‘thumbs up’
- An ergonomic keyboard enables a more natural posture
  - And requires less finger effort/reduces key reach
  - Which can minimize fatigue/RSI/Carpal Tunnel syndrome
  - 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
  o Describes how to operate / navigate through the system
    ▪ Using step by step examples / screenshots
      ● For example, printing a report
  ● Trouble shooting / help section
    o 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
    o Purchase standard software off the shelf from a computer store / online retailer
      ▪ Standard packages available
  ● In house
    o Develop the software in-house using software specialists / software department
      ▪ Some companies may not have required expertise
  ● Outsourcing
    o Outsource the development of the software to a third party
    o Software development company
      ▪ Companies can have specialist software designed specifically for their needs

Unit Testing
  ● Test data
    o Normal data
      ▪ Lies within the permissible range
        ● E.g. 2 for a month number
    o 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
  o Each user of the network is allocated specific rights to data files
  o Examples include read only / read and write
  o The access levels are maintained in an electronic table
  o Automatically checked when a user tries to access a data file

● Use a firewall
  o This monitors traffic into the network
  o Traffic must comply with the security policy
  o Different levels of security can be set
  o If the policy is not met, access is denied

How data can be transmitted on a network and kept secure

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

Anti-Virus Software

● It automatically
  o Checks / scans all transmitted files / programs / software
    ▪ Coming into the network
  o Via email / attachments / the Internet / portable devices
  o Against a database
  o Of known viruses / signatures
  o Which is updates to keep track of new viruses
  o Blocks / deletes anything identified as malicious to data
    ▪ E.g. spyware
  o 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
  o Entering the network
  o Or leaving the network
● Blocks / denies any messages
  o 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 supplies 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
  o 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
  o For example, C:\> the current directory or path

A Parameter

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

Access Rights

● Each user / group is allocated an access level
  o 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
  o Checks that they have appropriate level of access
    ▪ If they do not, access is denied
● Authorised Users
  o Access rights to data files
    ▪ Will be recorded in an access table
● When a user attempts to modify data
  o The user’s access rights will be checked in the access table
  o To ensure they have EDIT / MODIFY / DELETE access
  o Only if the user has appropriate rights will the modification be permitted

DVD-R

● Sufficient capacity to store a typical business application
  o 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 use’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 extract 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
  - Ss 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

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
  o Which are connected to the public telephone network /other exchange switches
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 results 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
  o As is disk cloning software
    ▪ Easily rendering many methods useless allowing piracy

● Legislation
  o Piracy is punishable by law, whether deliberate or not
  o Software will be covered by the Copyright, Designs and Patents Act
    ▪ Applies the concept of intellectual property / ownership to software
      ● Within the UK
  o The Act states that “an article is an infringing copy if its making constituted an infringement of the copyright in the work in question”
  o A licence will be required for the computer game
  o It will be illegal for anyone to copy the game without the companies permission / if not covered by a site / multiple user licence
  o It will be illegal for anyone to distribute the software without the companies permission / an appropriate licence
  o The penalties for breaking this Act include a term in prison and an unlimited fine
  o Legislation is difficult to enforce
  o Will be on the company to detect and prosecute offenders
  o 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/liaising 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
  o Relevant copies of part of the database will be held at each location
    ▪ As that is where it will be most frequently accessed
  o Data amendments will be implemented in the database at the
    appropriate location
  o The scattered versions of the database must be synchronised
    ▪ Ensuring they all have consistent data
  o 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 deskill