Information Systems & Characteristics

Characteristics of an Information System

- Organisation of data into meaningful information:
  - Sorting
  - Classifying
  - Grouping
- Analysing information to gain knowledge :
  - For further knowledge
  - Enhances knowledge gain

Manual Non-Computer Based Information Systems

- Before the development of computers:
  - Telephone books
  - Pen & Paper
  - Paper Receipts
  - Appointment books

Computer Based Systems

Development of Computers:

- Transaction processing systems (TPS)
  - Collects, stores & modifies transactions
  - Provides data to other systems
  - E.g. credit card systems, EFTPOS, POS terminals
- Management information systems (MIS)
  - Takes data & organises it - information reports (usually from TPS)
  - Provides information on the performance of an organisation
  - E.g. Execute information systems (EIS) – strategic issues

- Decision support systems (DSS)
    - Takes data (usually from TPS, MIS & external sources) to assist in decision making
    - Provides analysis tools, information & models
    - E.g. in statistical analysis, stock market, trade figures
    - Expert System:
        - ✧ Part of decision support system
        - ✧ Knowledge base and rules of inference
        - ✧ Same conclusion as human

- Office Automation System (OAS)
    - Manages vast data within an organisation
    - Improves efficiency, effectiveness - completing tasks
    - Software & communication technology e.g. voicemail, word processors, spread sheets

Examples of Database Information Systems

School Databases

- Environment
  - School community (students, staff, parents)
  - Authorities e.g. BOS, government
  - Any organisation, business, or individual that receives information generated by the school or supplies data for the system
- Purpose
  - To maintain the efficient operation of the school, personnel, resources & administration tasks
  - To provide information on student enrolments, subject selections & assessments for both school staff & educational authorities
- Data Mining
  - Information on people, resources & processes
  - Equipment registers, finance & purchase orders, library loans, staff information, timetables, student marks & grades
- Participants
  - Office & library staff who enter data
  - Teachers
- Information Technology
  - Barcode readers
  - Scanners
  - Software- spread sheet applications

Roads and Traffic Authority (RTA)

- Environment
  - Drivers, instructors, examiners
  - Vehicle owners, vehicle inspectors
  - Gov. departments e.g. NSW department of transport
  - Police & courts
- Purpose
  - Manage registration of all drivers & motor vehicles in NSW
  - Provide information to drivers/applicants on matters such as licensing, vehicle registration etc. as well as statistical information to government & other authorities
- Data/information
  - Drivers' details – contact, payment, driving history, license information
  - Vehicle owner details – registration numbers, payment, inspection records

- Participants
  - Data entry operators
  - Administration staff at offices
  - Inspectors
  - Police department- traffic branch

- Information technology
  - Computers
  - Cameras
  - Barcode scanners
  - Networking between computers

Video Shops

- Environment
  - Customers & staff
  - Suppliers
  - Other chain stores, head office
- Purpose
  - To keep accurate records of the stock (rental & sales)
  - To collect data for further analysis by store management
- Data/Information
  - Customer details (current loans, overdue items)
  - Rental records (in stock/on loans)
  - Saleable item records (videos, snacks)
  - Rental/Sales figures
- Participants
  - Staff who check out videos & other products, process returns, authorise orders for new stock
  - Head management
- Information technology
  - Computers
  - Barcode scanners
  - WAN link from head office (update new rental titles)
  - DB management & sales software
  - Network communication software

Organising Data

Flat-file Databases

- Simplistic data storage
- One table or file

File	Block of Data - Set of related records
Record	Set of one or more related fields (Tuple/row)
Filed	Specific Category of data in database (attribute/column)
Key fields	Used to uniquely identify a record in each file
Character	Smallest unit of data (letter/symbol)

Searching Databases

- Keys
  - Unlock required information
  - Allow to manipulate & retrieve info

- **Primary Keys**
  - Fields that store and retrieve data unique to a record
  - No blank values
  - Data not replicated in database
  - Primary or Compound

- **Secondary Keys**
  - Fields that store data, may not be unique
  - Single key or Compound key
  - Used to retrieve data may be common to group of records

- **Foreign Keys**
  - Field that is primary key field in one table, secondary key field in another table
  - Cannot exists in flat file bases
  - Exists in relational databases

- **Single and Compound Keys**
  - Single key -single field - represents (primary, secondary, foreign)
  - Compound Key (composite key) - two or more key fields
  - Compound key -represents primary, secondary, foreign key field

Relational Databases

- Consists of related tables
- Data organized within tables
- Every record in each table has unique field/fields
- Data redundancy minimized
- Data resides single location - consistency improved

Schema

- Organised plan of the entire database
- Show how & where data is found, description of data, data relationships
- Defines entities, attributes & relationship between entities
- Relationship diagram - entities and tables (ER diagrams)

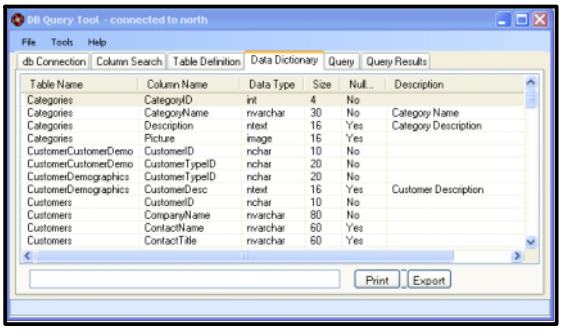
- Three way entities are related:
  - One to many: one record in the 1st entity relates to many records in the 2nd entity
  - One to one: one record in the 1st entity relates to 1 record in the 2nd
  - Many to many: each record in the 1st entity relates to many records in the 2nd

Entities	Specific title of which attributes are detailed under e.g. customer, orders
Attributes	Defined property of an entity e.g. Cust. ID, First name
Field names	Same as fields in a flat file database
Relationships	The way entities relate to each other

Data modelling

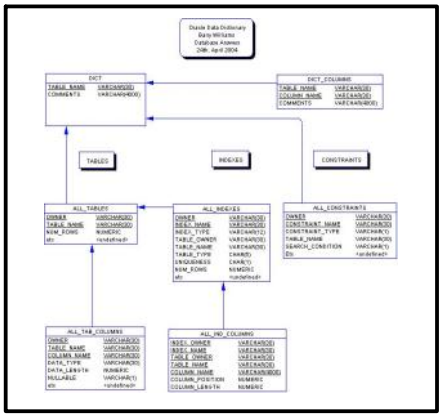
- Process of identifying entities, relationships between entities and attribute of these entities

Data Dictionary



- Describes characteristics of data- metadata
- Field name
- Data type
  - Alphanumeric: letters/numbers/symbols
  - Numeric: numbers & numeric symbols
  - Boolean/logical: true/false, yes/no
  - Date data: dd/mm/yy
  - Time data: hh/mm
- Data format
- Field size- number of characters allowed in the field
- Description- explains contents of the field
- Example- illustrates content

Schematic Diagram



- Graphical tools that assist describing databases.
- Assist in development of relational databases
- Assists in defining databases

Normalisation

- Process of organising data into separate relations:
- Reduces data redundancy:
    - Removing repeating fields
    - Reorganising data where needed
    - Avoids inconsistencies among values
- Analysing data to create the most efficient database structure

1st Normal Form

- Columns and rows
- No multi - valued attributes
- Has Non-null primary key (primary key have value)
- No duplicates rows

2nd Normal Form

- It is in 1st Normal form
- All non key attributes functional dependent on full primary key

3rd Normal Form

- It is in 2nd normal form
- Determinates are candidate keys
- (determinates - attribute that determines value of another attribute)

Hypermedia

- Storage/linking of media & documents
- May contain text, numbers, images, audio, animation & video
- Each document is independent & can be retrieved electronically using hypertext

Nodes	Computer that has destination of the link
Links	Links nodes in a hyper document- associated with bookmarks & anchors
URL	Universal resource locators (Address of file/resource on the web)

Protocol	Allows access to web pages based on hypertext- 'http'
Domain name	Address of specific computer where resource is located 'www.whatever.com'
File path	Path followed to the file being retrieved

Storyboards

- Series of frames - representing different action or screen image
- Consists of navigation paths -information & graphics

Linear	Sequential path
Hierarchical	Choices branch off into further choices, based on navigation
Non-linear	No structure- free navigation
Composite	Mix of all layers

Webpage Creation Software

- Allows text, graphics & sounds to be hyperlinked
- HTML tags inserted automatically by the software

Storage and Retrieval

Database Management Systems

- Software management package - allows admin to manage database
- DMBS used to:
    - Provide data access
    - Organize data to tables
    - Allow data to be vied differently
    - Allow specific data to be retrieved using queries
    - Presents data in formatted reports
    - Validation
    - Establish / Maintain security

Data Interdependence

- Data must be independent of computer structure
- Goal of DBMS - present interface - logical structure of data in database
- Physical data interdependence - relation physical and logical structures

Accessing Data

- Sequential
    - Record must be accessed in a linear progression, from 1st to last
    - E.g. accessing data on magnetic tap
- Direct
    - Data accessed in any order i.e. without accessing previous data items
    - Immediate access, regardless of organisation
    - E.g. storing data on disc & logical location of data within a database

Distributed Databases

- Database located in more that one area
- Various sections located in more that one area
- Lessens demand on overall database
- Consist of mirroring

Storage Devices

Data stored for future retrieval:

- Hard discs
  - Stores data magnetically on precision aluminium or glass platters
  - Direct access

- CD-ROMs
  - Data is read & written using laser technology
  - Direct access

- Cartridges
  - Magnetic tape encased in a cartridge
  - If it is linear -> sequential
  - If it is non-linear -> direct

- Magnetic tape
  - Stores large amounts of data inexpensively
  - Used for backup
  - Sequential access
  - Erasable, reusable

How to determine Storage requirements for a Database

Field name	Data type	Width	Long name	Description	Example
FName	Text	15	Family name		Raftopoulos
GName	Text	15	Given name		Valentini
Height	Numeric	4	Height	Height without shoes in metres	1.87
Weight (kg)	Numeric	5	Body weight	Weight in bathing suit in kilograms	56.6
DOB	Date	8	Date of birth	Date of birth	13/03/81
Financial	Boolean	1	Financially paid up	Membership current this year?	Y

Table 2.4.5b Storage calculation

Field name	Character spaces	Number of records	
Fname	15		
Gname	15		
Height	4		
Weight	5		
DOB	8		
Financial	1		
	48 characters = 48 bytes STORAGE for 1 record	1000	TOTAL STORAGE REQUIRED for 1000 records = 48 000 bytes = 48 000/1024 Kb = 46.875Kb

Encryption

Encryption	Encoding of its data to mask its meaning
Private Key	Decryption key that is only available to recipient of information

- *Encryption*
  - Process of encoding data -> maintains confidentiality & security
  - Algorithm or key is required to encode the data
  - Involves manipulations of bit patterns
  - *Asymmetric*
    - Requires public key for encryption & a private key for decryption
  - *Symmetric*
    - Same key required for encryption & decryption e.g. DES

- *Decryption*
  - Process of decoding data -> receiver can translate
  - Reverse algorithm or key is required to decode the data

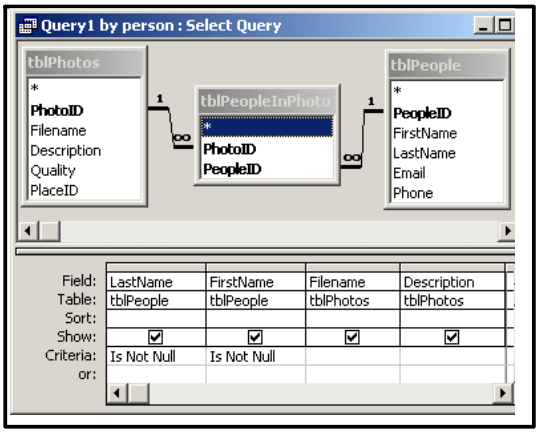
Sorting & Querying

Sorting Data

- DBMS allows user set up calculated fields - using numerical values
- When sorted, duplicate data in primary field
- Secondary fields - second level sort
- By sorting - manipulating

Searching Databases Using query language

- Query by example - list tables and prompts user to provide conditions for query
- Structured Query language - industry standard, no proprietary
- Coding - SQL
  - SELECT
  - WHERE
  - FROM



- Use operators - values compared
- Operators allow - queries discriminatory
- Wildcards -? (substitutes one character)
- Wildcards - * (string of one or more commands)

Operators

- Allow queries to be discriminatory
- Information extracted
- Two types:
    - Relational Operators
    - Logical Operators

Operator	Result
==	Equal to
!=	Not equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to

LOGCIAL OPERATOR	MEANING
AND	Both conditions
OR	Either one condition
NOT	NOT TRUE condition= FALSE condition

Query Language	A database search language
SQL	Standard structure query language used in relational databases
Relational Operators	Operators that allows objects or values to be compared
Logical Operators	Operators that are used to combine statements or conditions

Tools for hypermedia search & retrieval

- Free text searching
    - Technique for searching a computer based document or database for characters or words
    - Search engine searches all words and tries to match search words supplied by the user
- Search engines
    - Indexing- databases of indexed websites that can be searched using keywords
    - Search robots- programs that facilitate indexing by accessing websites & gathering information
    - Metadata

Other Information Processes

Reports

- Reporting- formatted & organised presentation of information
  E.g. mailing labels, invoices, sales summaries & telephone lists
- Constructing different views of a database for different purposes e.g. form- used to enter, view & edit data

Issues Relating to Information Systems & Databases

Data Verification

- Permission from source to use data before publication
- Data source acknowledged
- Ensures justification of outputs e.g. results from surveys
- Provides a mechanism for tracking & auditing data -> determines accuracy of data
- Legal requirements- copyright
- Gives company credibility

Data Accuracy

- System must be able to resist user mistakes, system malfunctions, deliberate & accidental alteration
- Error detection & correction methods
- Accuracy of data sources e.g. Wikipedia very unreliable, BOM reliable
- Validation procedures
    - Range Check
    - List Check
    - Data Type Check
    - Check sum or check digit

Data Bias

- Data bias- the way the data is collected, interpreted & manipulated
- Data - factual
- Not emotionally driven
- Statistically removed during data manipulation stage

Backup Procedures

- Manual Backup Systems
- Full Periodic System backups
- Daily Transaction Backups
- Offsite Backup systems

Security

- Restricting unauthorised access
- Logical restrictions:
    - Password
    - Restricted level of access
    - Limited access time
    - Workstation access
    - Firewall
    - Encrypted data
- Physical; Restrictions:
    - Access to workspace
    - Restricted access buildings
    - Restricted use of Wi-Fi
    - Hardware firewalls

Privacy

- Protects an individual's personal information e.g. health, racial, criminal, financial
- Security measures - prevent unauthorised access
- Organisations/corporations - abide principles -maintain legal compliance and ethical reputation

Data Warehousing

- Stores raw data which is collected electronically from a variety of sources
- Data may be available for sale to interested parties -> privacy issue e.g. medical records, credit cards etc.
- E.g. real estate agency may buy information from council

Data Mining

- Process of searching through data, trying to match any patterns e.g. customers with common interest
- Highlights relationships
- Security issue e.g. centralising personal information into 1 warehouse
- Used By\ :
    - Military purposes
    - Emails
    - retail