01 Zero & One

Unit 9: Databases

Programming & AI, 1st secondary (Introduction to ICT)



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9-1 Database [1]

- **Database and DBMS**: **Database:** an organised collection of data, stored in a way that makes it easy to access for a specific purpose
- **The five DBMS functions**
  - **Data consistency:** when several people change the same data at the same time, no contradictions appear.
  - **Data integrity:** prevents duplication, tampering and unauthorised registration or updating.
  - **Data independence:** the database is managed **separately** from the programs that use it.
  - **Data confidentiality:** setting **access permissions** and performing **authentication**.
  - **Data availability: backups**, restoration and recovery, so data comes back after a failure.
- **How to tell them apart**
  - Two people book the same seat at the same moment → **consistency**.
  - Someone tries to register the same student twice or change a grade without permission → **integrity**.
  - We changed the phone app and the data stayed the same → **independence**.
  - Passwords and permissions: the teacher edits, the student only views → **confidentiality**.
  - The hard disk broke and we restored the data from a backup → **availability**.
- **Types of databases**
  - **Hierarchical database:** data in a **tree** structure (one parent with children below it).
  - **Network database:** data in a **web / mesh**-like structure
  - **Relational database:** data organised in **multiple tables** linked to each other.
  - **NoSQL:** any database management systems **other than** relational ones.

Database	An organised collection of data stored so it is easy to access, search, process and share.
Database management system (DBMS)	A system that creates, operates and manages databases.
Data consistency	Making sure concurrent operations on shared data do not cause contradictions.
Data integrity	Preventing duplication, tampering and unauthorised registration or updating of data.
Data independence	Managing the database separately from the programs that use it.
Data confidentiality	Setting access permissions and performing authentication.
Data availability	Backups, restoration and recovery so data can be recovered after a failure.
Hierarchical database	A database that stores data in a tree-like structure.
Network database	A database that stores data in a web or mesh-like structure.
NoSQL	Database management systems other than relational ones.

9-2 Database [2]

- **Relational database (RDB)**: **Relational database (RDB):** data is organised and managed in **multiple tables** linked to each other.
- **Why build relationships?**: When we set **relationships** between tables, we remove **duplicate data**, so the data is handled **with integrity**.
- **Structured query language (SQL)**: **SQL:** is a language used in relational databases to **manipulate data**: registration, insertion, retrieval and deletion.
- **Relational database operations**
  - **Selection:** extract only the **rows** that meet a condition
  - **Projection:** show only certain **columns** of the table
  - **Join:** link data from **multiple tables** by a condition (such as the club code) and show it as one table.

Relational database (RDB)	A database that organises data in multiple linked tables.
Table	A grid of data made of rows (records) and columns (fields).
Record	One row of a table.
Field	One column of a table.
Relationship	A link between tables that removes duplicate data.
SQL	A language for registering, inserting, retrieving and deleting data in a relational database.
Selection	An operation that extracts only the rows meeting a condition.
Projection	An operation that shows only certain columns of a table.
Join	An operation that links multiple tables by a condition into one table.

9-3 Various Information Systems

- **Information systems around us**: **Information systems:** are made of people, computers and ICT equipment, and they use the network to **collect, share and transmit** data.
- **The four systems in a company**
  - **Transaction processing system (TPS):** records and processes **routine daily** transactions
  - **Management information system (MIS):** gives managers **periodic reports** to help them decide
  - **Decision support system (DSS):** helps managers make **non-routine** decisions through modelling and simulation
  - **Executive information system (EIS):** gives **top executives** a summary of the whole organisation's performance
- **System integration**
  - **Vertical integration:** linking systems at **different levels** of the organisation, such as TPS with MIS.
  - **Horizontal integration:** linking systems at the **same level** across different departments, such as the sales system with the inventory system.
- **Enterprise resource planning (ERP)**: **ERP:** is an integrated system that combines a company's different functions

Information system	People, computers and networks working together to collect, share and transmit data.
TPS	Transaction processing system: records routine daily transactions.

MIS	Management information system: gives managers periodic reports.
DSS	Decision support system: helps with non-routine decisions through modelling and simulation.
EIS	Executive information system: gives top management a summary of overall performance.
Vertical Integration	Linking systems at different levels of an organisation.
Horizontal Integration	Linking systems at the same level across different departments.
ERP	Enterprise resource planning: one integrated system for accounting, HR, supply chain and customers.
POS system	Point of sale system: collects sales data at the moment a product is sold.
GPS	Global positioning system: finds a location using satellite data.



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