2.3 Interacting With Data (RDB)

Database

- Computer based record keeping system
  - Record keeping system: A manual or automated system that collects, organise and categorise records, facilitating their preservation, retrieval, use and disposition
- Collection of data to meet an organisation's information needs
- Computer files that are optimised to store data in a structured way
- Organisation of files helps to ensure that data is accurate
- Properties of a relational table:
  1. Values are atomic: columns are non-repeating
  2. Each row is unique
  3. Column values are of the same kind: all values come from the same domain (i.e. integers/strings)
  4. Sequence of columns is insignificant
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  6. Each column has a unique name
- Examples:
  - Library system:
    - Location of books
    - Students' and teachers' details
    - Loaning history
  - Student system
    - Students' particulars
    - Results and grades
  - Resource booking system
    - Booking of venues and facilities
    - Details of booking: location, time slot
  - Human resource system
    - Workers' details
    - Leave information
    - Payroll
  - Inventory system
    - Items in warehouse
    - Stock level

- **Flat-file Database:** Holds all data in an unstructured table

    - Each file consists a table of related information defined by Rows and Columns
        - Rows: "Records"
        - Columns: "Fields"
    - Drawbacks:
        - Duplicated data is unnecessarily entered
            - Database space is wasted with this duplicated data
            - Duplicated data takes a long time to enter and update (unnecessary)
        - Data redundancy

- **Relational Database:** Stores data and how the data are related
    - Organises data into one or more tables
    - Each table represents one entity type
    - Reduces redundancy
    - Types of relationship:
        - One to one
        - One to many
        - Many to many
    - Entity Relationship Diagram (ER):
        - Visual representation of different data using conventions that describe how these data are related
        - Shows structure of data in a database
        - Building blocks:
            - Entity: Rectangle
            - Relationship: Diamond
    - Shorthand Notation:
        - E.g. Student (Student ID, Name, NRIC, Address, Telephone)
        - Key Field / Primary Key:
            - Underlined (Student ID)
            - Unique, used to identify a particular Record
        - Composite Key:
            - Primary Key that consists more than one field
            - E.g. Name + Surname
        - Candidate Keys:
            - Table may have one or more choices for primary key
            - Collectively known as candidate key
            - Table can choose which key to be used as primary key, other key becomes secondary key
        - Foreign key:

        - A column/columns in a table that draws values from a primary key in another table
        - Assists in ensuring the data integrity of a table
        - Not required to be unique
- Normalisation:
    - To process data to more efficiently manage data
    - To isolate data so that additions/deletions/modifications of a field can be made in just one table and then propagated through the rest of the database using defined relationships
    - First Normal Form:
        - Make sure that any attributes with multiple values are removed so that records are of the same length
    - Second Normal Form (assume relation in first normal form):
        - All attributes in an entity must be functionally dependent (unique association) with the primary key for the purpose of identification
        - Each field is unique to its key field
    - Third Normal Form (assume relation in second normal form):
        - There is no transitive functional dependency
        - All non-key attributes are fully functional dependent only on the primary key
        - There isn't an extra table to describe relationship between the non-key attributes