2.3 Interacting With Data (RDB)

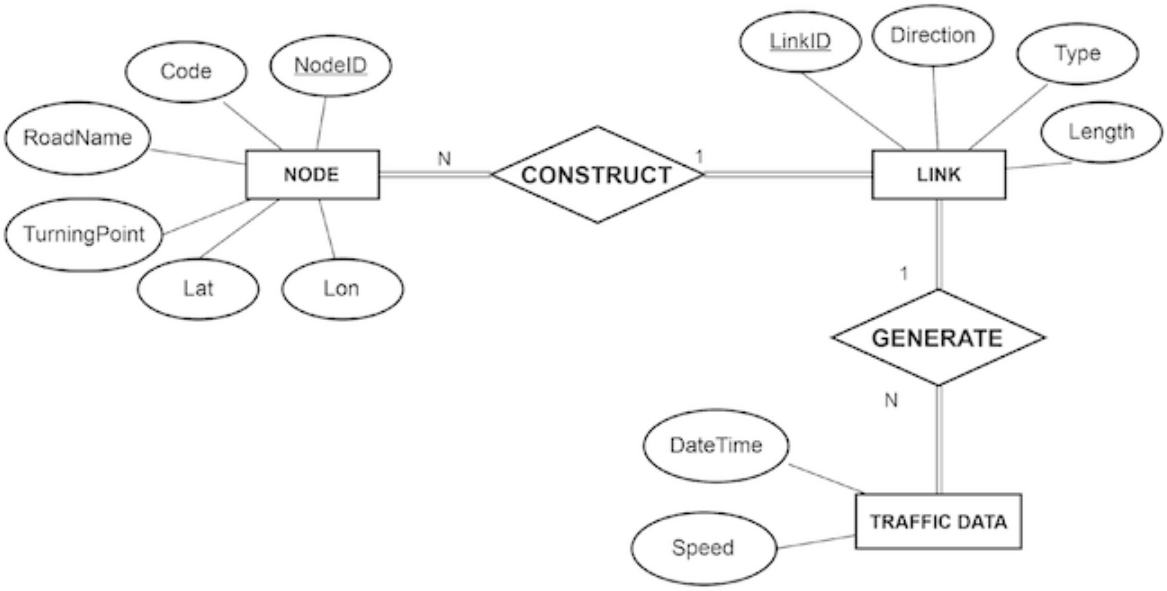
Database

- 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
  5. Sequence of columns is insignificant
  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