



O N L I N E

L E A R N I N G

Introduction to Data Structures & Algorithms

SCSJ2013 Data Structures & Algorithms

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Objectives:

- problem solving
- algorithm concept
- data structure concept

Problem Solving

- Taking the **statement of a problem** and **develop a computer program** to solve problems.
- The entire process requires to pass **many phases**

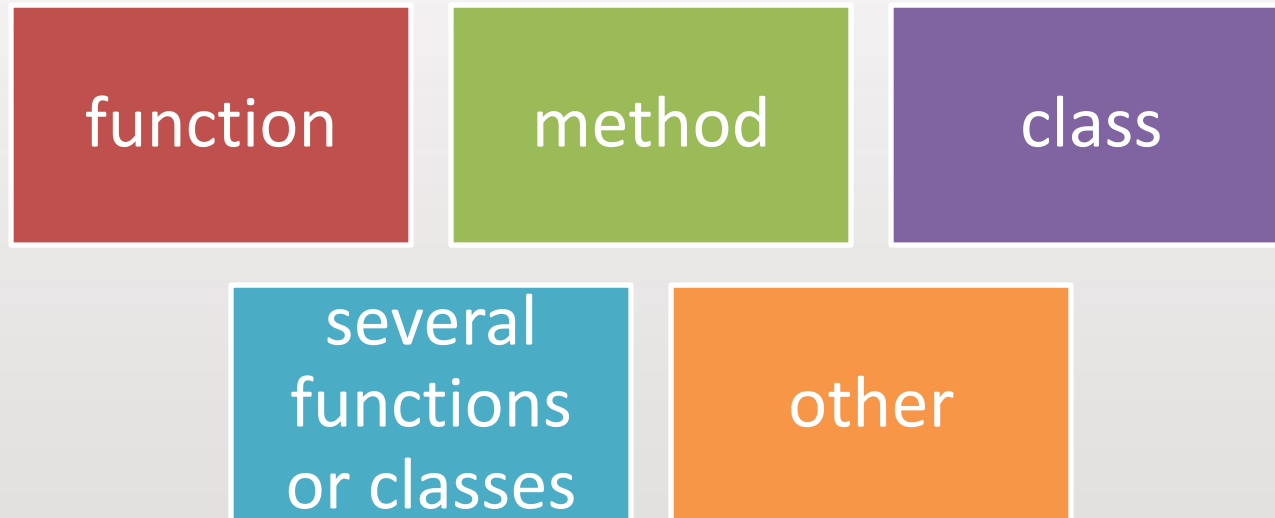
understanding
the problem

design
solution

implement the
solution

Problem Solving

- A **solution** to a problem is computer program written in programming language which consist of **modules**.
- Type of **Modules**:



Problem Solving

- A **good solution** consists of **Modules** that
 - organize **data collection** to facilitate operations
 - must store, move, and alter data
 - use **algorithms** to communicate with one another
- **Advantage** of module:

Constructing
programs

Debugging
programs

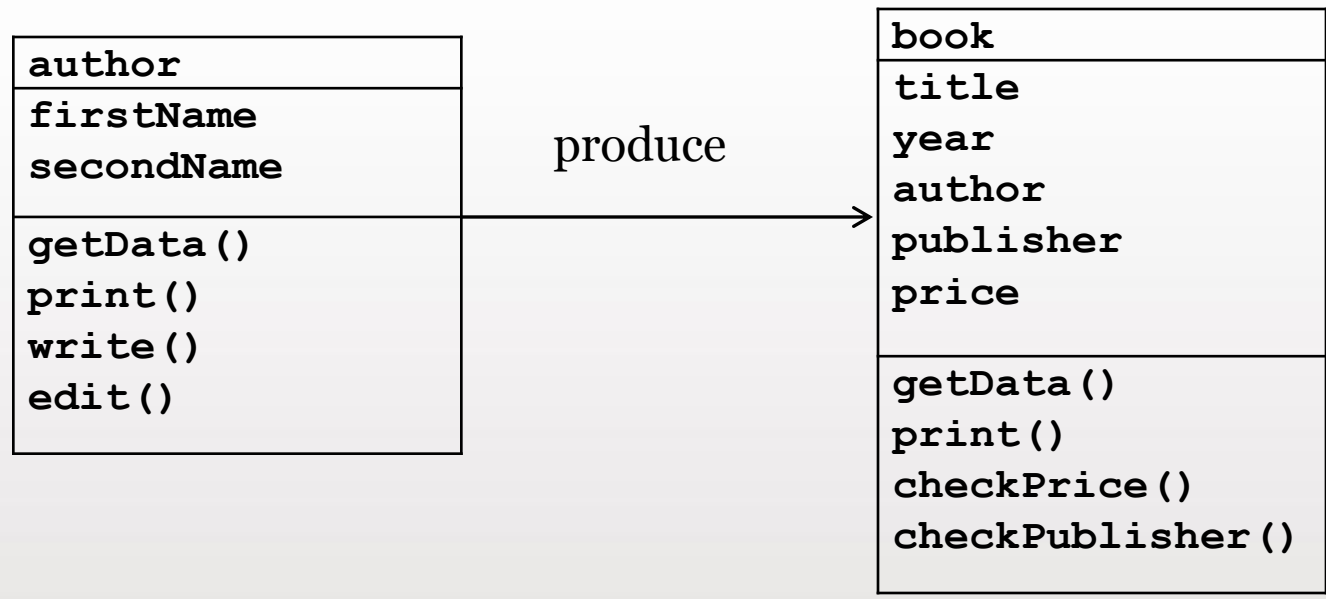
Reading
programs

Modifying
programs

Eliminating
redundant
code



Problem Solving - Modularity Example





Algorithm

- Module **implements** algorithms

- Algorithm

step-by-step recipe for performing a task

operate on a collection of data

problem solving using logic

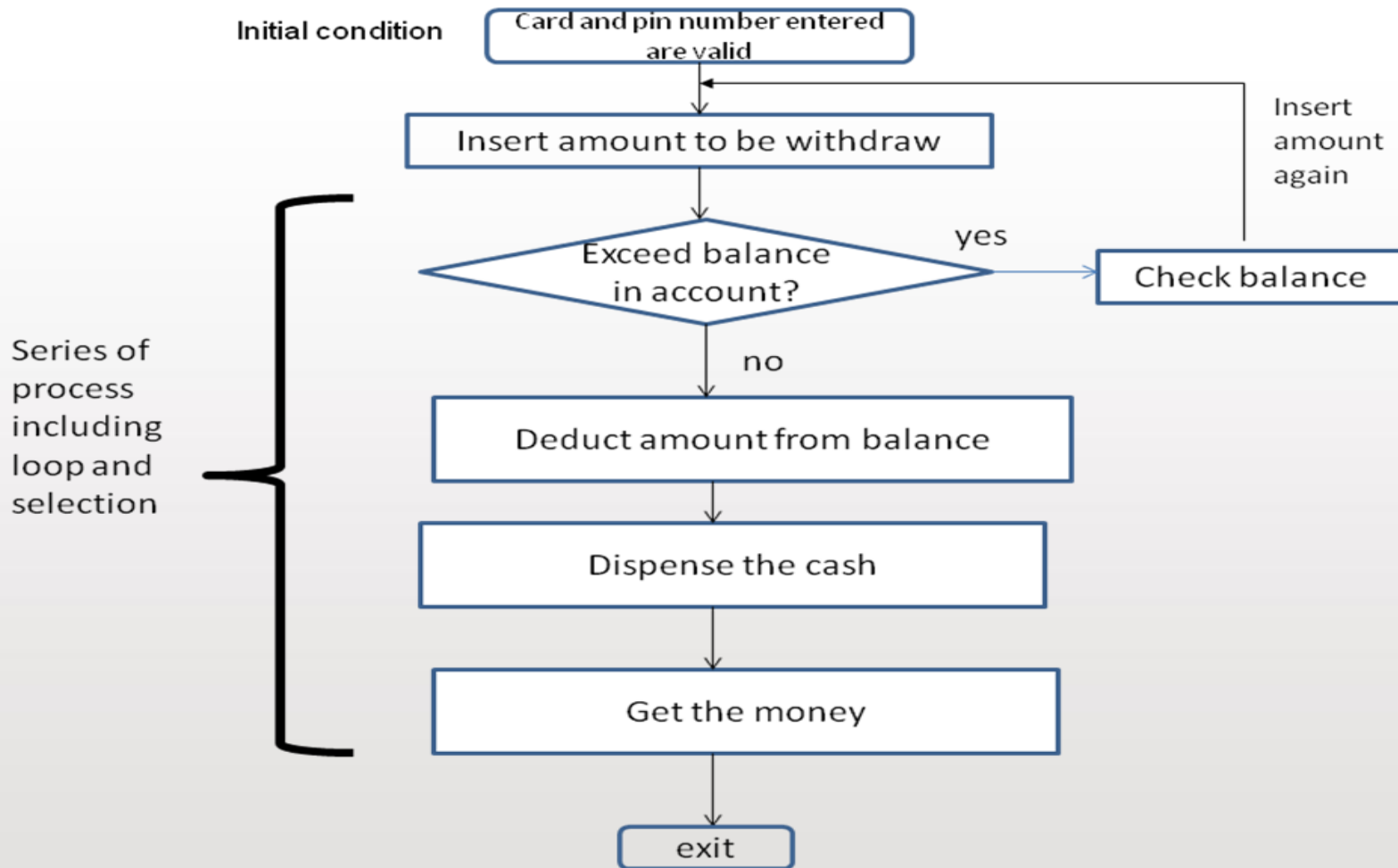


Algorithm

- Well-defined instructions in algorithm includes:
 1. when given an **initial state** (INPUT)
 2. proceed through a well-defined **series of successive states** (PROCESS)
 3. eventually **terminating** in an end-state (OUTPUT)



Algorithm

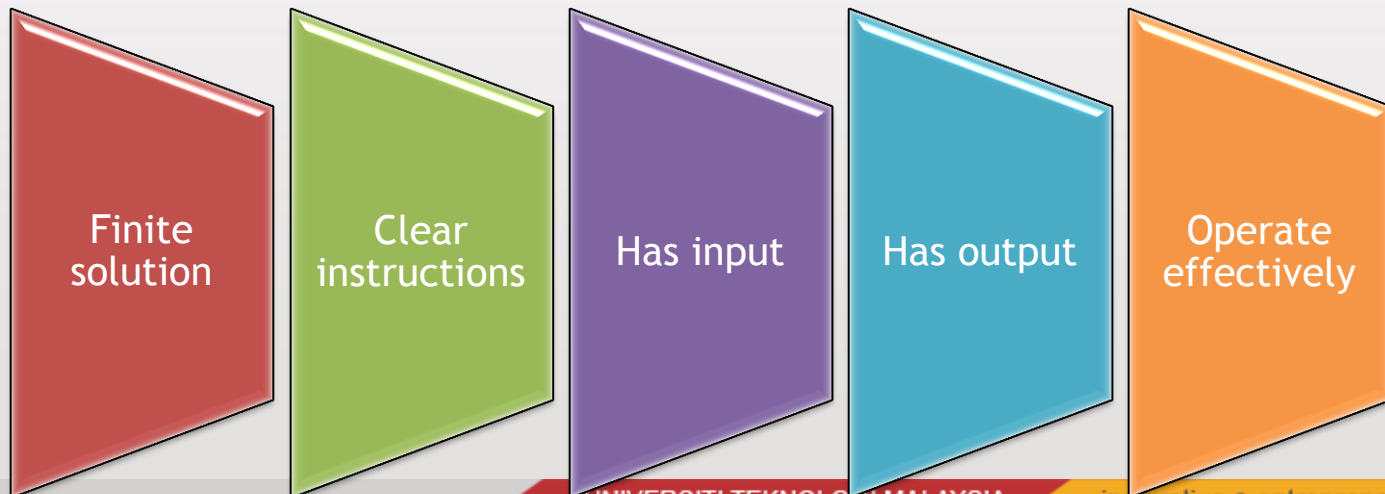


Algorithm

- 3 types of algorithm basic control structure



- Basic algorithm characteristics



Algorithm

- The techniques to design algorithm are such as:
 - Flowchart, pseudo code, State machine and others
- Factors for measuring good algorithm

Running time

Total memory usage

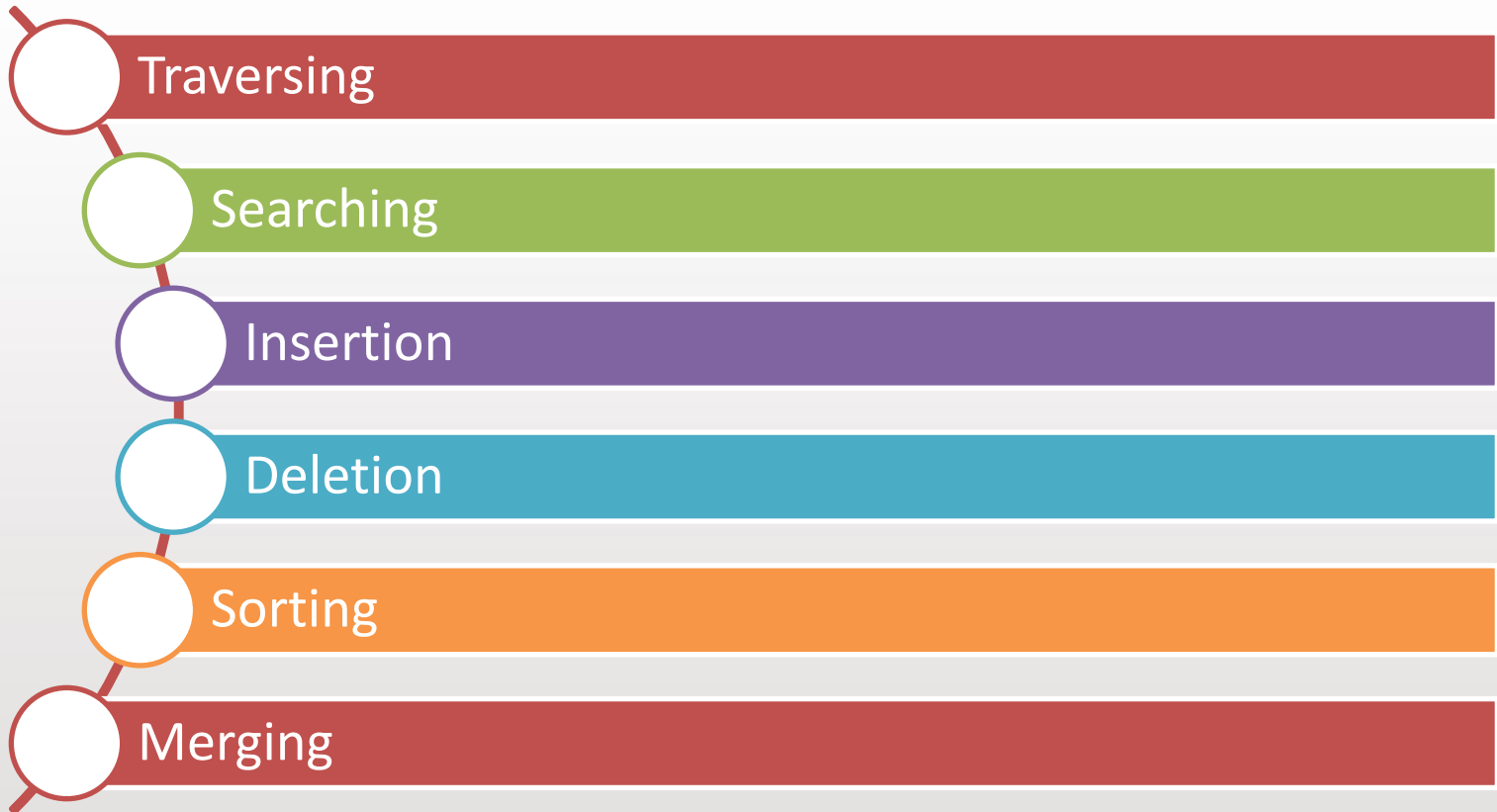


Data Structure

- Data Structure
 - A way of **storing and organizing** data in a computer so that it can be used **efficiently**
- Choosing the **right** data structure will allow the most **efficient** algorithm to be used
- A well-designed data structure :
 - allows a variety of **critical operations** to be performed
 - enable to use **few resources** (for both execution time and memory space as possible)

Data Structure

Operations to the Data Structure





Data Types

- **2 data types**

- Basic data types

- Structured data types

- **Basic Data Types (C++) – store only a single data**

- **Integral**

- Boolean – bool
 - Enumeration – enum
 - Character - char
 - Integer – short, int, long
 - Floating point – float, double



Data Types

- Unsorted Linked List
- Sorted Linked List

Linked Structure

- Network

- Binary Tree

- Graph

Storage Structure

- Array

- Structure (struct)

Structured Data Types

State Structure

- Queue

- Stack

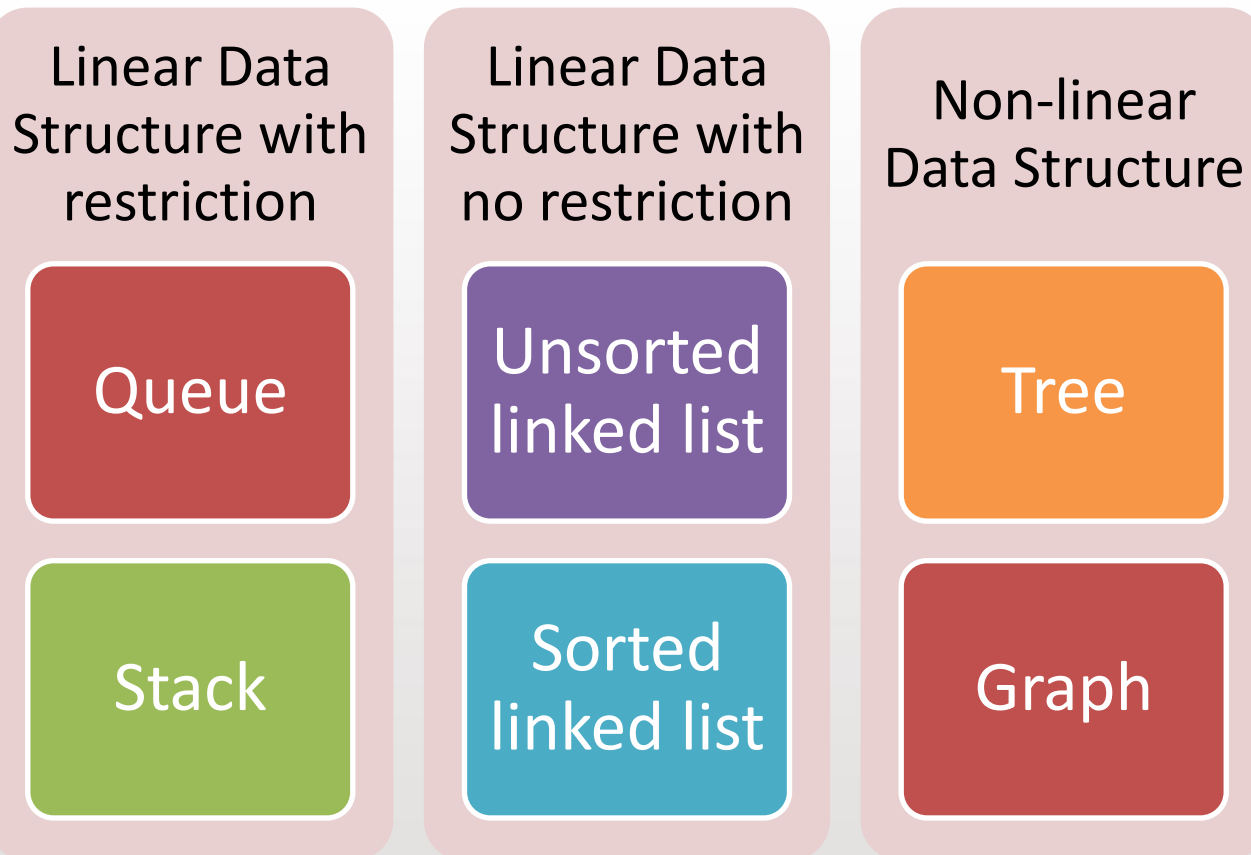


Storage Structure

- Storage Structure
 - Array
 - Structure

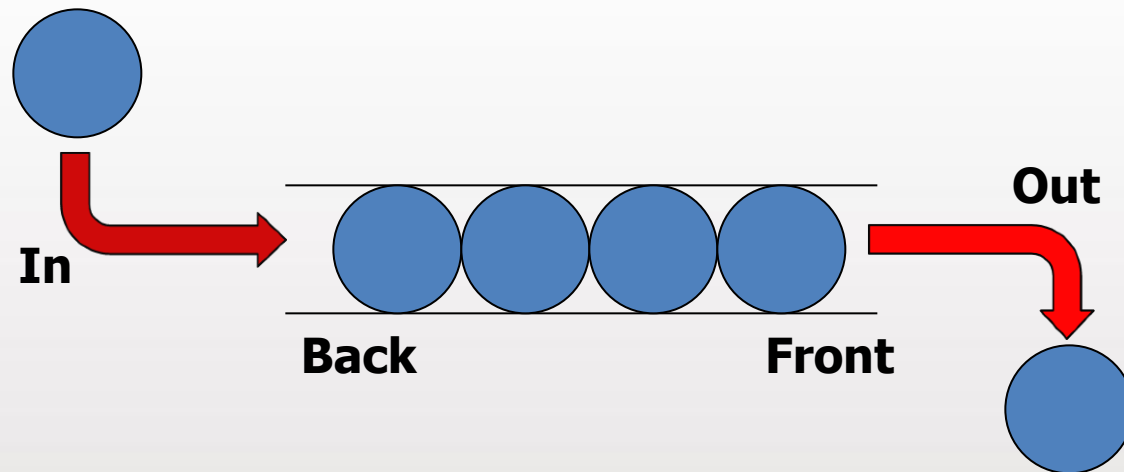
```
typedef struct {  
    int age;  
    char name[25];  
    enum {male, female} gender;  
} Person;  
  
Person student[30];
```


Linked Data Structure



Linear Data Structure with restriction

- Queue



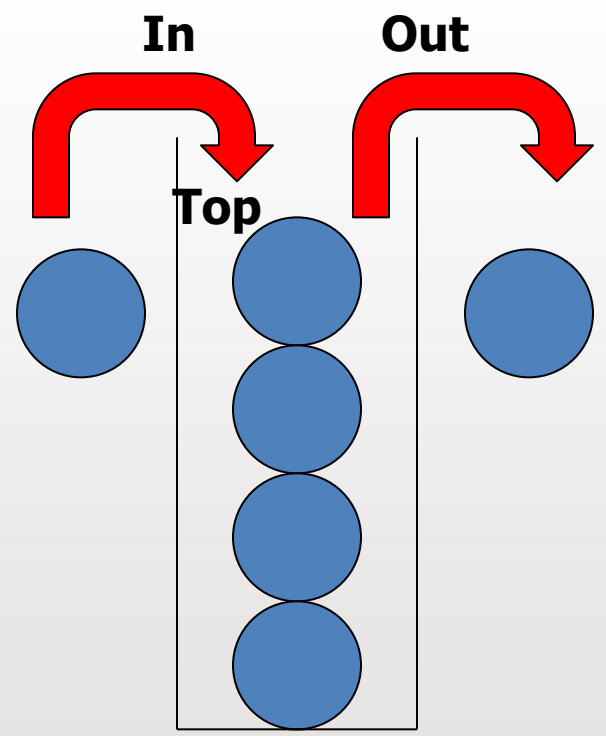
Queue Application





Linear Data Structure with restriction

- Stack





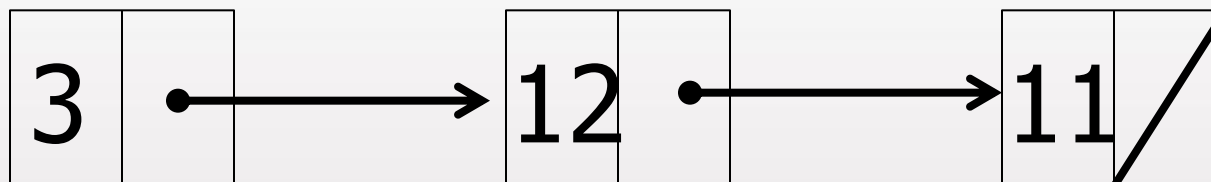
Stack Application





Linear Data Structure with no restriction

- **Linked list**



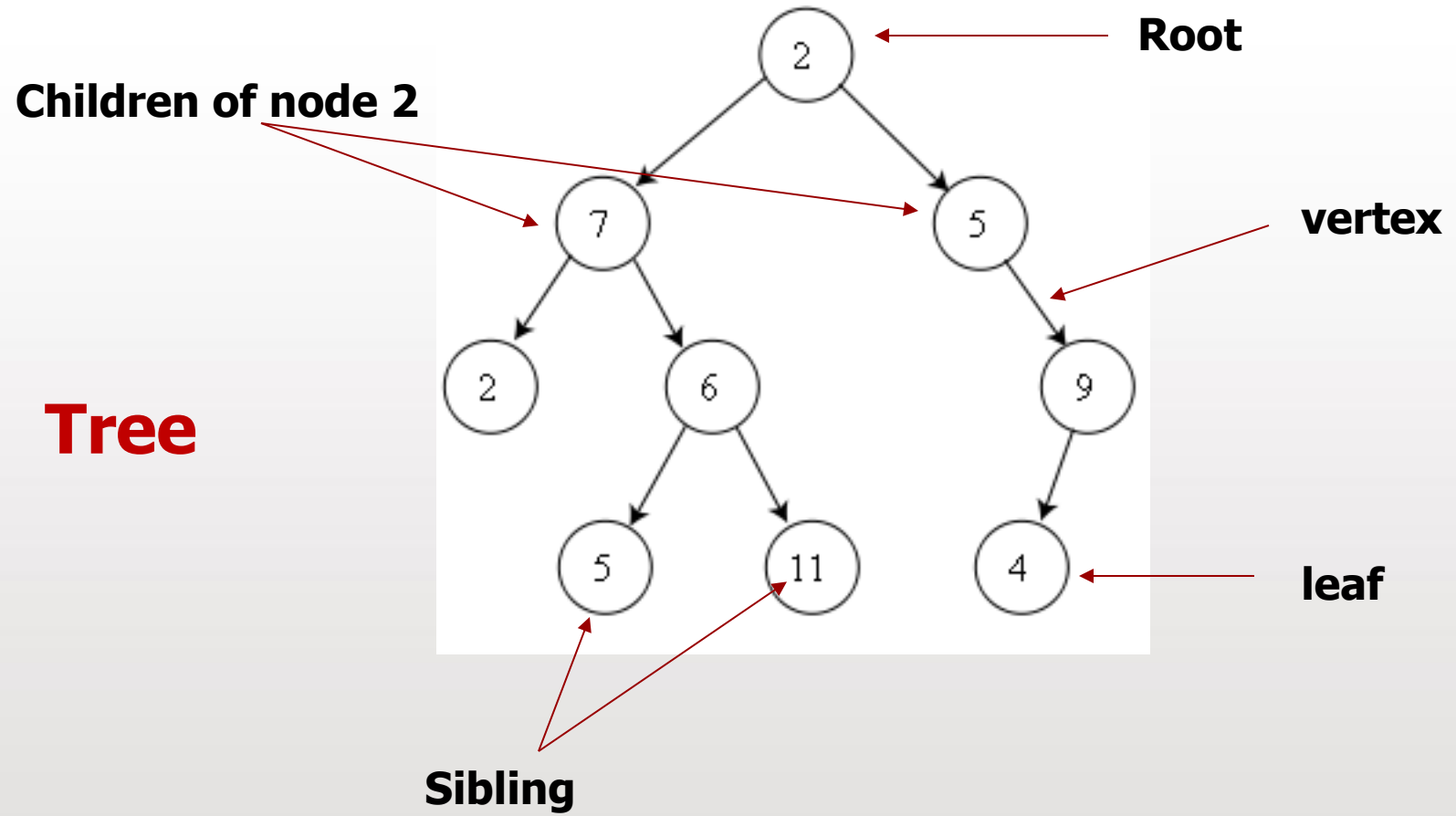


Linear Data Structure with no restriction

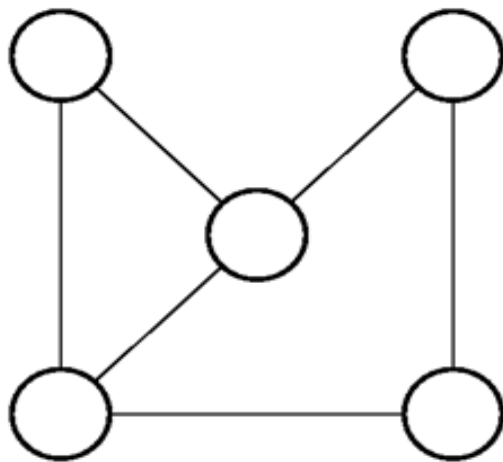
- **Sorted linked list**
 - Data stored in **ascending or descending** order with no duplicates
 - **Insertion** at front, middle or rear of the list
 - **Deletion** will not affect the ascending / descending order of the list
- **Unsorted linked list**
 - A linked list with **no ordering**



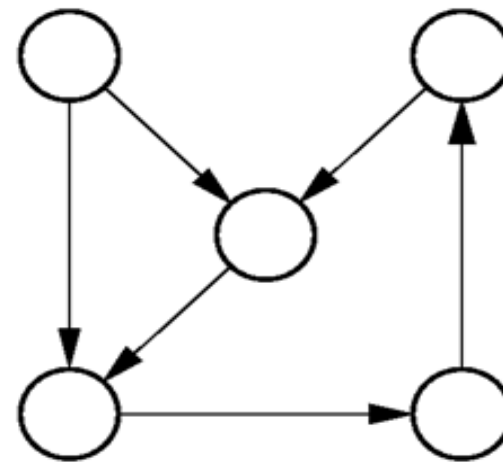
Non-linear Data Structure



Non-linear Data Structure



Directed

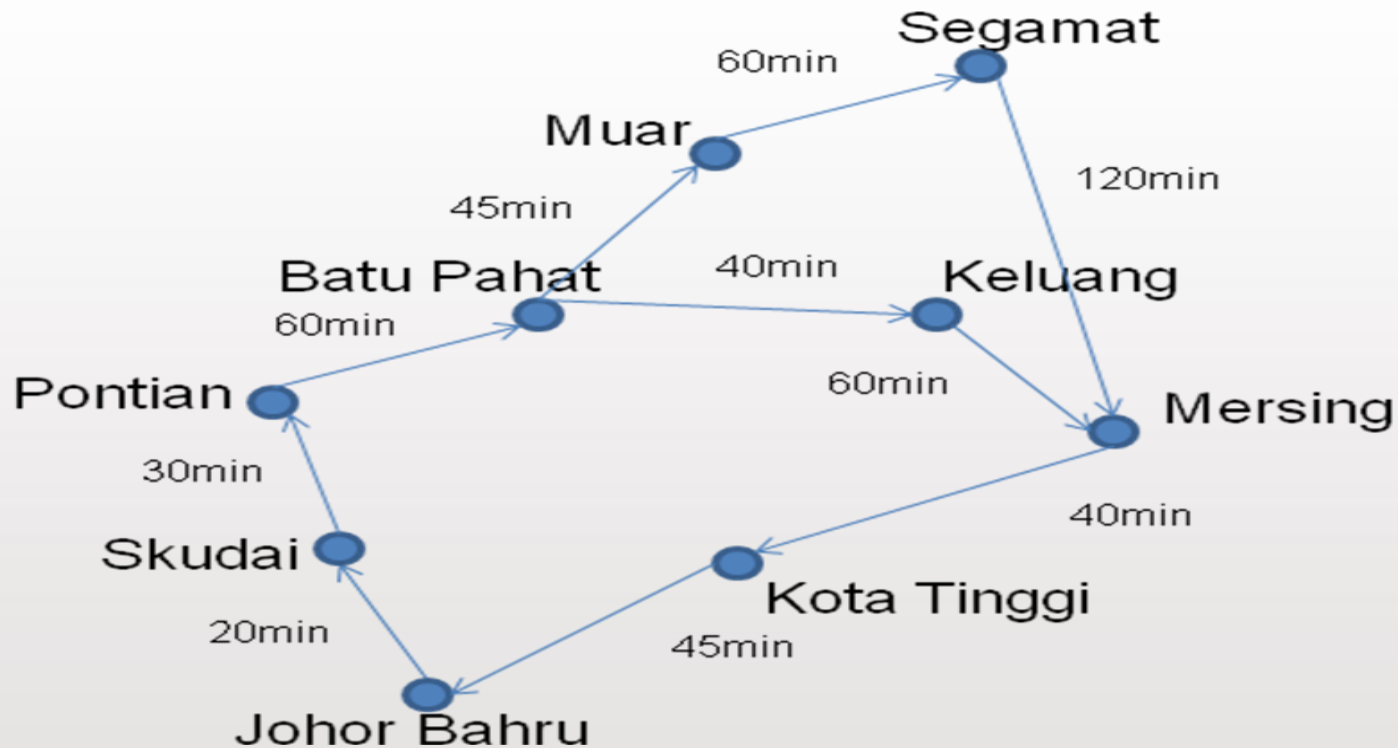


Undirected graph

Graph

Non-linear Data Structure

- Weighted network



Conclusion

- In this class you have learned about:
 - Problem solving is the entire process of taking the **statement of a problem** and **develop a computer program** to solve problems.
 - Algorithm is **step-by-step** recipe for performing a task **operate on a collection of data**
 - Data structure is a way of **storing and organizing** data in a computer, it allows **efficient algorithm** to be used
 - The knowledge given is to ensure that you are able to provide good solution to problem solving

Thank You



<http://comp.utm.my/>