



# UNIVERSITY OF RUHUNA

## Faculty of Engineering

End-Semester 4, Examination in Engineering, December 2015

Module Number: EE4303    Module Name: Data Structures and Algorithms

### Part-B

[2 hours]

[Answer all questions, each question carries 7.5 marks]

Q1. a) Tree data structures can be used for searching.

- i) Draw the resulting tree when you insert the following number sequence to an empty binary search tree.

45, 34, 65, 22, 40, 50, 76, 10, 30, 55

[1 marks]

- ii) Write an algorithm to find a node with a given key value.

[1.5 marks]

b) AVL tree is a special binary search tree.

- i) Explain the AVL property of a node.

[1 marks]

- ii) Explain single and double rotation methods you follow to preserve AVL property during insertion.

[2 marks]

- iii) Draw the resulting tree diagrams when you insert following sequences to an AVL tree.

50, 70, 90, 120, 150, 80, 170

[2 marks]

Q2. a) Array and Linked Lists are basic data structures.

- i) Explain using a diagram, how an Array and a Linked List are stored in main memory.

[1 marks]

- ii) Give one advantage and one disadvantage of an Array over a Linked List.

[1 marks]

- b) Singly Linked List can be represented using a Node class and LinkedList class.
- i) Write the Node class. [1 marks]
  - ii) Write a method to print node data in the list. [1 marks]
  - iii) Write a method to insert an element to the end of the Singly Linked List class. [1.5 marks]
  - iv) Write a method to delete an element from given position from a Singly Linked List class. [2 marks]

Q3. a) Quick sort algorithm is one of the basic sorting algorithms.

- i) Explain the algorithm using last element of an array as the pivot element. [1.5 marks]
- ii) Calculate the asymptotic time complexity of the algorithm for worst case and best case. [1.5 mark]

b) Given input sequence (4371, 1323, 6173, 4111, 4299, 9669, 1989) and a hash function  $h(X) = X \pmod{10}$ , show the result of

- i) Separate chaining hash table. [1.5 marks]
- ii) Open addressing hash table using linear probing. [1.5 marks]
- iii) Open addressing with second hash function  $h_2(x) = 7 - (X \pmod{7})$  [1.5 marks]

Q4. a) Explain how you would represent graph shown in Figure Q4.a using adjacency list and adjacency matrix. [2 marks]

b) Explain the breadth first search operation on the graph shown in Figure Q4.a taking  $s$  as the starting node.. [1.5 mark]

c) Explain Prim's algorithm for finding the minimum spanning tree shown in Figure Q4.a taking  $a$  as the starting node. [2 mark]

d) Explain the Dijkstra's algorithm for finding shortest paths from vertex  $s$  in the weighted graph shown in Figure Q4.d. [2 mark]

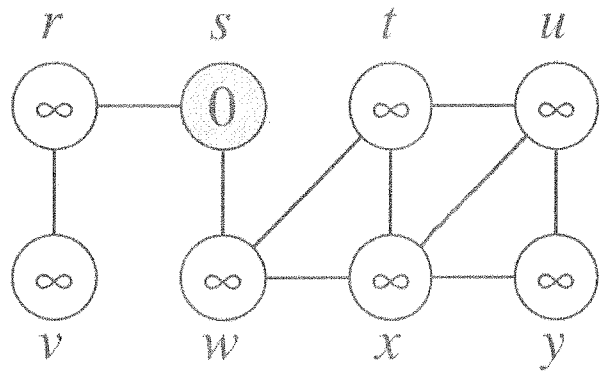


Figure Q4.a: A figure of an undirected graph.

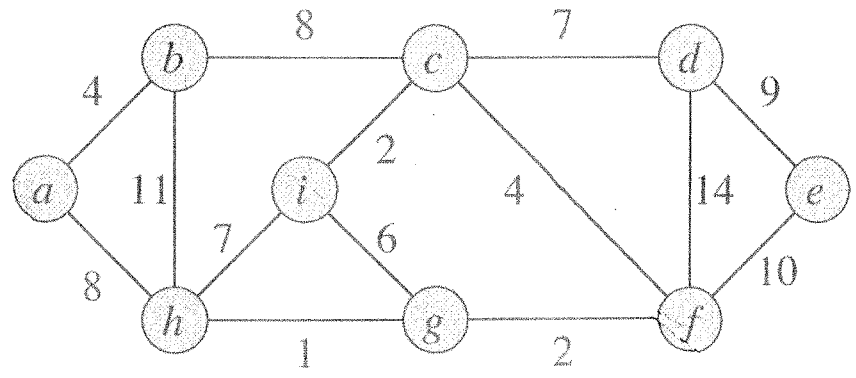


Figure Q4.c: A figure of a weighted undirected graph.

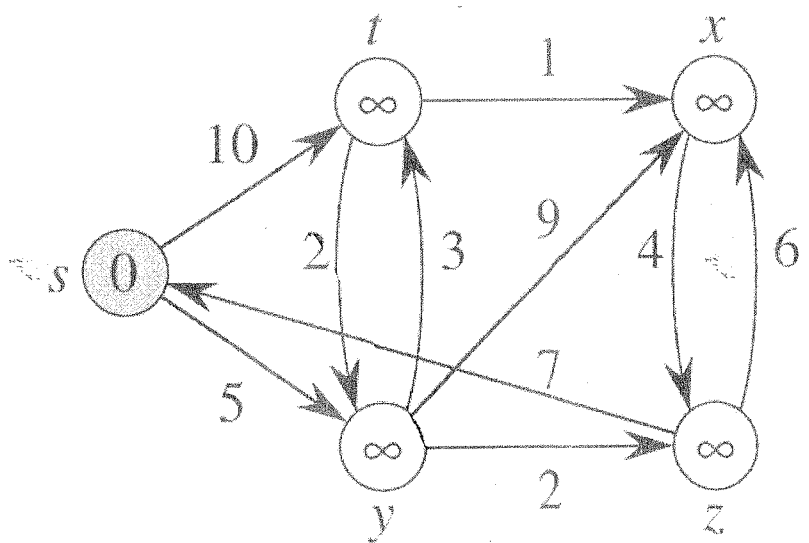


Figure Q4.d: A figure of a weighted directed graph.