CSIT113
Problem Solving

TUTORIAL 4 – FOR UNIT 8
GRAPH AND TREE FOR MODELLING

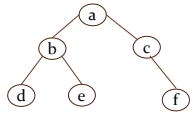
Lecturer/Tutor: Dr Tan Hee Beng Kuan
(email: hbktan@uow.edu.au)

UNIVERSITY OF WOLLONGONG AUSTRALIA

SIM GLOBAL EDUCATION

Question 1

Traverse the following binary tree: (a) in preorder; (b) in inorder; (c) in postorder:



Show the contents of the traversal.

Answer:

(a) a, nodes in L-subtree of a nodes in R-subtree of a

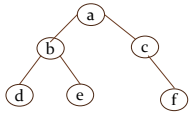
a, b, d, e, nodes in R-subtree of a

a, b, d, e, c, f

a, b, d, e, c, f

Question 1

Traverse the following binary tree: (a) in preorder; (b) in inorder; (c) in postorder:



Show the contents of the traversal.

Answer:

(b) nodes in L-subtree of a , a, nodes in R-subtree of a

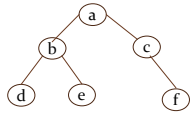
d, b, e, a, nodes in R-subtree of a

d, b, e, a, c, f

d, b, e, a, c, f

Question 1

The Traverse the following binary tree: (a) in preorder; (b) in inorder; (c) in postorder:



Show the contents of the traversal.

Answer:

(c) nodes in L-subtree of a nodes in R-subtreea of a , a

d, e, b, nodes in R-subtree of a ,a

d, e, b, f, c, a

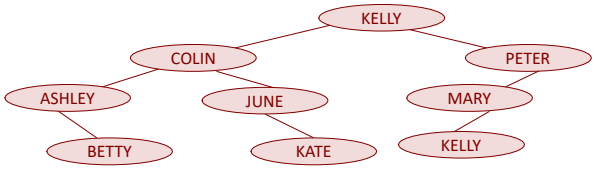
d, e, b, f, c, a

Question 2

Construct a binary search tree (BST) based on the words given below. The words are to be inserted from left to right. Which traversal of the tree will result in a list of words in alphabetical order?

KELLY	PETER	MARY	COLIN	KELLY	JUNE	ASHLEY	BETTY	KATE

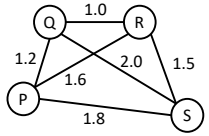
Answer:



Inorder traversal of the tree will result in a list of words in alphabetical order.

Question 3

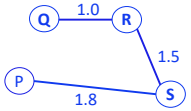
The graph below shows the connection and distance in kilometers between the different buildings of a university:



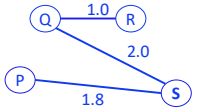
From the given graph, derive two possible spanning trees and specify their costs.

Answer:

There are many other possible answers. . Two of them are below:



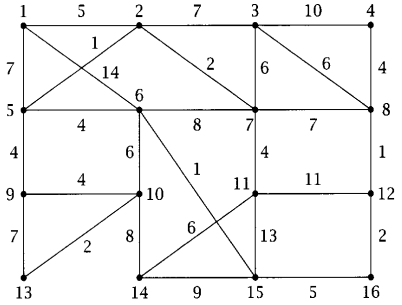
Cost = 4.3



Cost = 4.8

Question 4

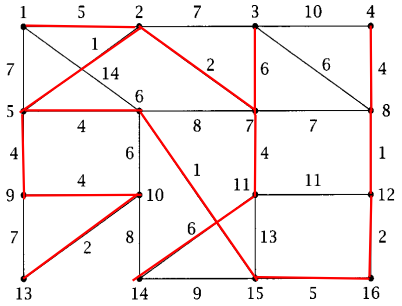
Find the minimum spanning tree of the following graph by using Prim's algorithm.



Question 4 --- Answer

A minimum spanning tree can be formed by starting from vertex 2 (can start from any vertex) and selecting the edges according to the following order (shown in red colour):

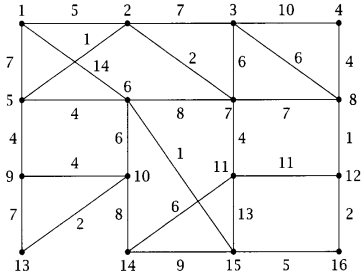
(2,5), (2,7), (5, 6), (6,15), (7, 11), (5, 9), (9,10), (10, 13), (15,16), (16,12), (12,8), (8, 4), (2,1), (7, 3), (11,14)



The minimum total weight = 1 + 2 +4 +1 +4 +5 +4 +4+ 2 + 5 + 2 + 1+ 4 +6 + 6 = 51

Question 5

List the order in which the vertices of the following graph are visited when breadth-first-search algorithm is applied with the start vertex = 4:



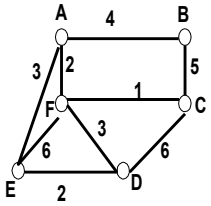
Assume that the vertices are listed in increasing order in each adjacency list.

Answer:

4, 3, 8, 2, 7, 12, 1, 5, 6, 11, 16, 9, 10, 15, 14, 13

Question 6

In the graph shown in the following figure, each node represents a city and each edge represents the cost for building a road to connect two cities:

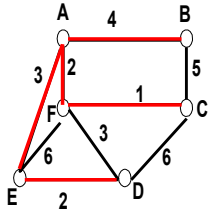


Use an algorithm that you have learnt to draw a graph to show the roads that we should build to connect all the cities such that the total cost is minimum.

Question 6

Answer: Using Kruskal's Algorithm, we construct a MST by selecting the edges in the following order (in red colour):

(F, C), (A, F), (E, D), (A, E), (A, B)

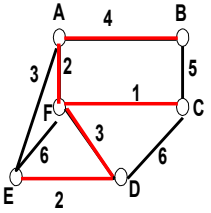


Total Minimum Cost = 1 + 2 + 2 + 3 + 4 = 12

Question 6

Another Answer (not needed when answering questions, just for reference): Using Kruskal's Algorithm, we can also construct a MST by selecting the edges in the following order (in red colour):

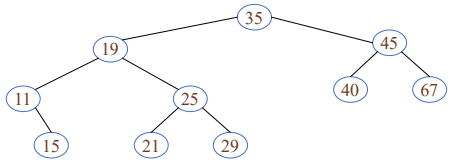
(F, C), (E, D), (A, F), (F, D), (A, B)



Total Minimum Cost = 1 + 2 + 2 + 3 + 4 = 15

Question 7

Consider the following binary search tree (BST):

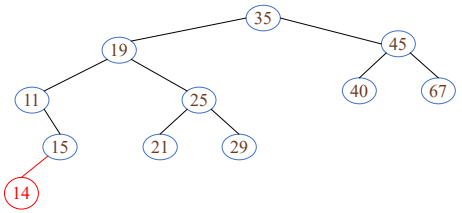


Show the resulting BST after each following insertion/deletion according to the order shown:

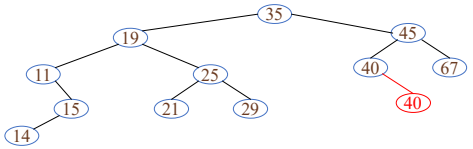
i) 14 is inserted
ii) 40 is inserted
iii) 25 is deleted
iv) 45 is deleted

Question 7

Answer:
(i) Insert 14:

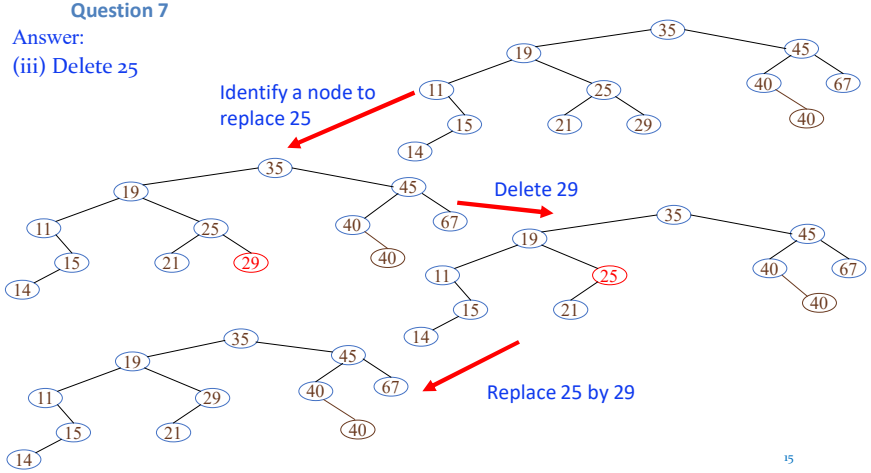


(ii) Insert 40:



Question 7

Answer:
(iii) Delete 25



Question 7

Answer:
(iv) Delete 45