UvaWellassa University, Sri Lanka
Faculty of Science and Technology
Computer Science and Technology Degree program
1st Semester Examination – March/ April 2013

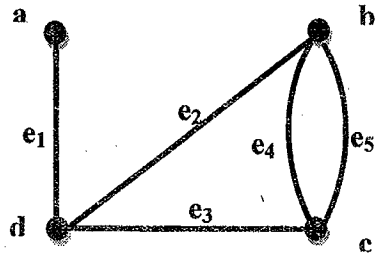
Uva Wellassa University

CST 475-2 Graph Theory

Instructions to candidates
Number of questions: Four (04)
Answer all questions
Time allocation: Two (02) hours
Total marks allocated: 100

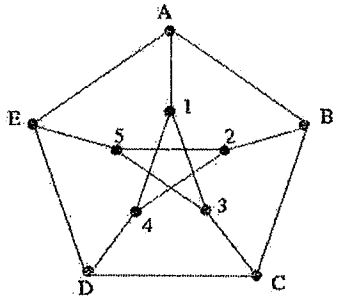
1.

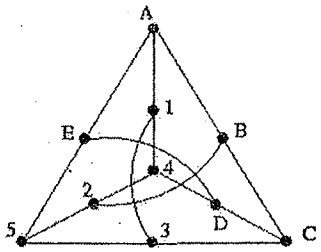
a. Write down the Adjacency Matrix and the Incidence Matrix for the following graph.



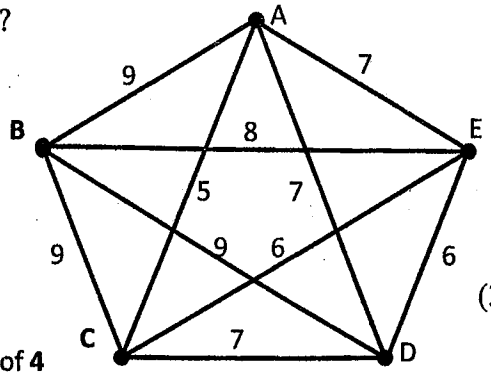
b. Draw the graph whose adjacency matrix is given by $\begin{pmatrix} 1 & 2 & 1 \\ 2 & 0 & 2 \\ 0 & 2 & 2 \end{pmatrix}$.

c. Determine whether the following pair of graphs is isomorphic.





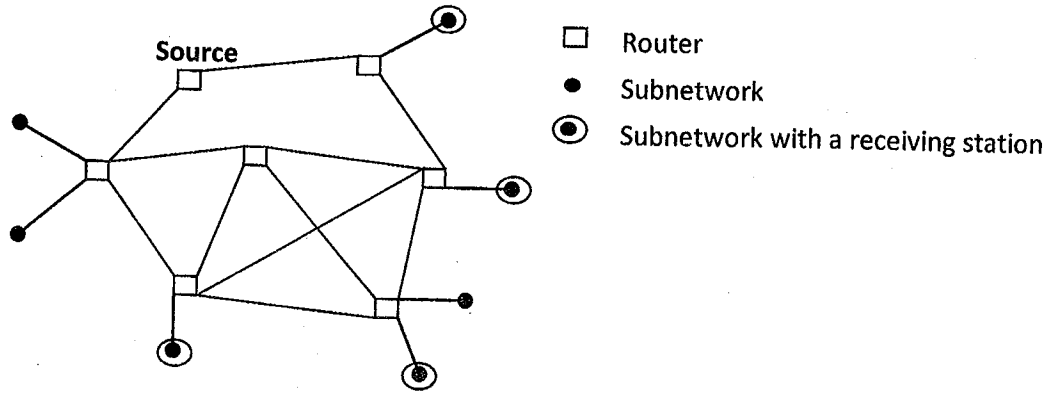
d. A travelling salesman must visit every city in his territory exactly once and then returns to the starting point. The cost of travel between all cities are given on edges . How should he plan his journey for minimum total cost?



(30marks)

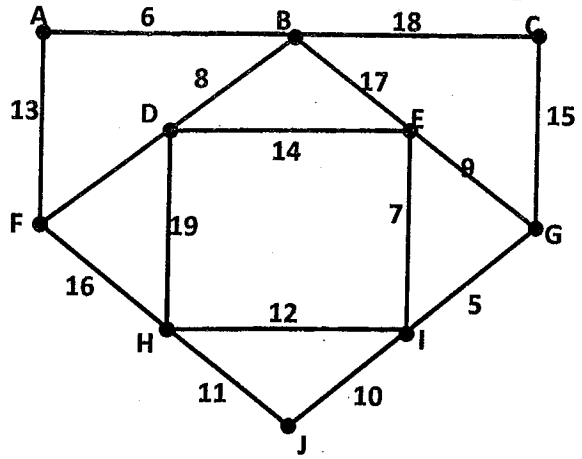
2.

a. Spanning trees play an important role in Multicasting over Internet Protocol (IP) network. To send data from a source computer to multiple receiving computers, each of which is a subnetwork, data could be sent separately to each computer. For data to reach receiving computers as quickly as possible, there should be no loop (Cycles) in the path that data take through the network. To avoid loops, the multicast routers use network algorithms to construct a spanning tree in the graph that has multicast source, the routers and the subnetwork containing receiving computers as vertices, with edges representing the link between computers and /or routers. The root of this spanning tree is multicast source. The receiving computers of subnetworks are leaves of the tree. Draw the spanning tree for the given Multicasting



IP Multicasting network

b. The following network has 10 vertices (A, B, C, D, E, F, G, H, I and J). The weights on each edge represent the distances, in kilometers, between pair of vertices.

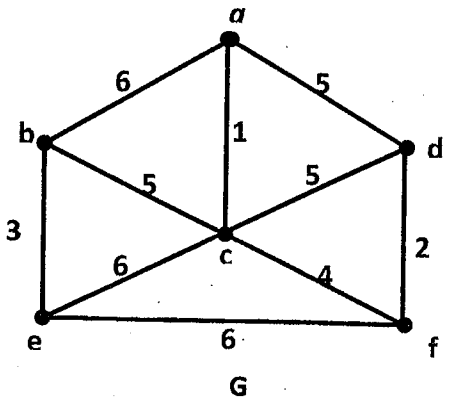


i. Use Kruskal's algorithm to obtain the minimum spanning tree for the network

ii. Compute the length of the minimum spanning tree

iii. Draw the minimum spanning tree

c. Let G be the weighted graph. Find the minimum weighted spanning tree T of G using Primes's algorithm

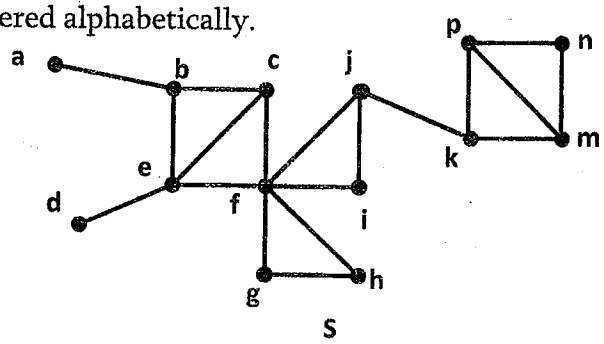


G

(30marks)

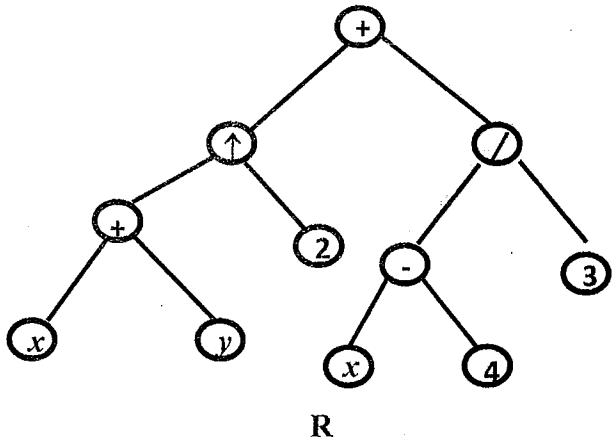
3.

a. Use the Depth First Search and the Breadth First Search to obtain spanning trees of S, rooted at b. The vertices are ordered alphabetically.



S

b. The ordered rooted tree (R) corresponding to a arithmetic expressions which is in the in-fix notation is given.



R

Write down the

i. pre-fix notation expression for the tree R

ii. post-fix notation expression for the tree R

c. Evaluate the following mathematical expressions

i. + − * 2 3 5 / ↑ 2 3 4 in pre-fix notation

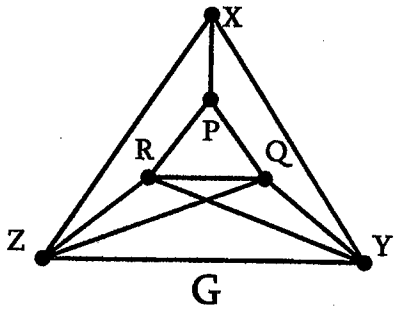
ii. 7 2 3 * − 4 ↑ 9 3 / + in post-fix notation (20 marks)

31

4.

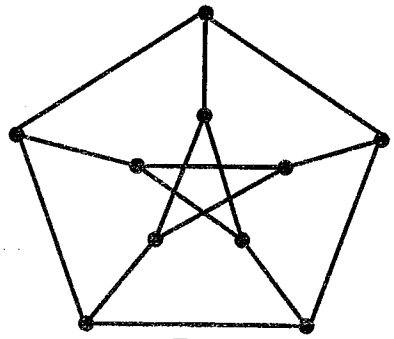
a. Define the chromatic number for a graph

b. Show that the graph G is isomorphic to bipartite graph K_{33}. Is the graph G Planar?



G

c. The *Petersen* graph P is given below. What is the Chromatic number of P? Justify your answer.


P

d. There are 8 final exams to be scheduled, Math 115, Math 116, Math 185, Math 195, CS 101, CS 102, CS 273, and CS 473. If there are no students taking both Math 155 and CS 473, both math 116 and CS 473, both Math 195 and CS 101, both Math 195 and CS 102, both Math 115 and Math 116, both Math 115 and Math 185 and both Math 185 and Math 195, but there are students in every other combination of courses. Use graph colouring to schedule the above exams with fewest number of different time slots.

(20 marks)