Bengal Engineering and Science University, Shibpur

B. E Part IV 7th Semester (CST) Final Examination, 2011

Subject: Graph Algorithms — Paper: CS-705/5
Time: Time-3 Hours — Full Marks: 70

Answer questions from both the halves

FIRST HALF

Answer any TWO questions.

1. In an Ice Cream Company's factory, six different flavors of ice cream are produced in sequence on one giant machine. The machine must be cleaned after each flavor before the production of next flavour and the cleaning time depends on the two flavors (but we will assume that it does not matter which of the two flavors is mixed first). The company wishes to find an ordering of six flavors, starting with banana, so that, if the machine produces the six flavors, (once and) only once in a day and in this order, the total cleaning time spent is smallest possible. The cleaning time(in minutes) are given in the following table.

	Banana	Chocolate	Mint	Raspberry	Strawberry	Vanilla
Banana	0	10	11	11	6	10
Chocolate	10	0	17	15	15	20
Mint	11	17	0	10	15	19
Raspberry	11	15	10	0	15	20
Strawberry	6	15	15	15	0	11
Vanilla	10	20	19	20	11	0

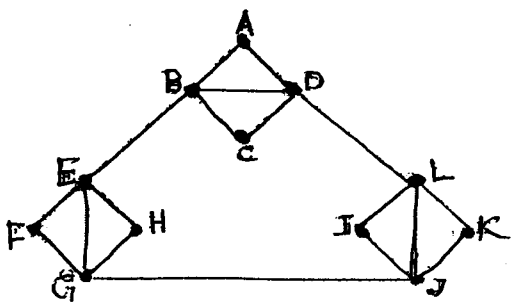
Obtain a reasonably efficient cleaning time cycle for ice cream machine using:

a) Vertex Insertion algorithm.
b) Christofides algorithm. [8 + 9.5]

2 a) Describe Konigsberg Bridge Problem, with suitable diagrams, as a problem in graph theory. Why is it impossible to find a solution of Konigsberg Bridge Problem?

b) Define and give example: Bridge. Hence write Fleury's algorithm to find Euler tour.

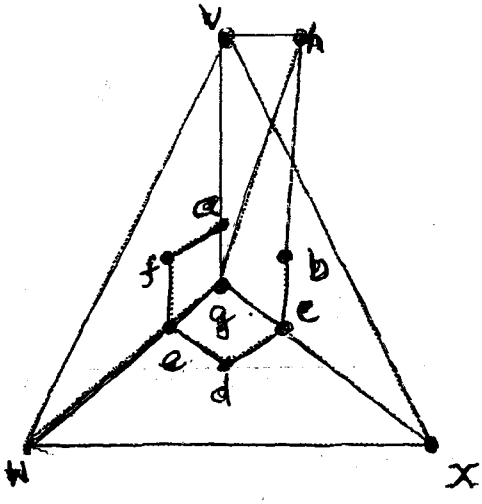
c) Obtain Euler's tour for the following graph using Fleury's algorithm.



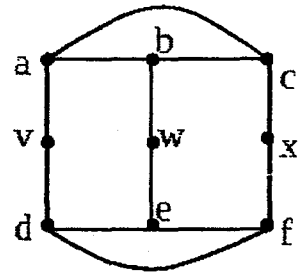
[(3 + 2) + (2 + 4) + 6.5]

3 a) For the following prove that the graphs are not Hamiltonian.

i)



ii)

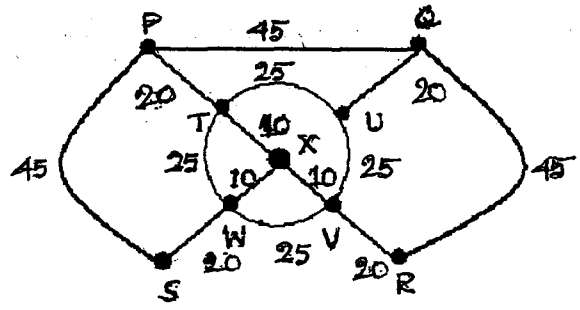


b) Find RNA chain(s) whose G and UC-fragments are given below, using sub-fragmentation approach and mentioning the necessary sequence of steps you have followed.

G-fragments: CCG, G, UCCG, AAAG.

UC-fragments : GGAAAG, GU, C, C, C, C. [(4 + 4) + 9.5]

4 a) The vertices of the following graph represent the chalets in a small holiday park and the arcs represent the paths between them, with the lengths of the paths given in metres. A gardener wishes to sweep all the paths, starting and finishing at P, and to do so by walking (always on the paths) as short a distance as possible. Apply the Chinese postman algorithm to find the shortest distance the gardener must walk, and give one possible shortest route.



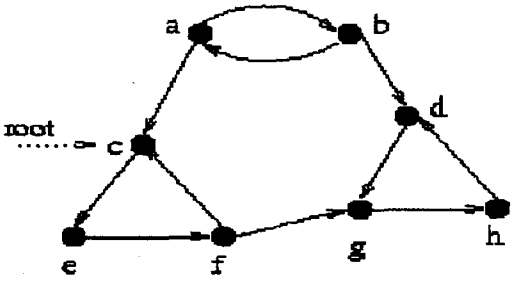
b) Define: De Bruijn Sequence of order k, De Bruijn graph of order k. In these contexts define left shift, cyclic shift and de Bruijn shift operations.

c) State De Bruijn Theoem.

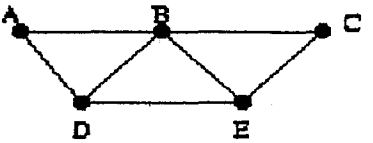
d) Draw a De Bruijn graph of order 1 of binary string. Separately extend it to De Bruijn graph of order 2 and obtain all possible De Bruijn sequence of order 3 from it. [6.5 + 5 + 1+ (1 + 4)]

Answer any TWO questions.

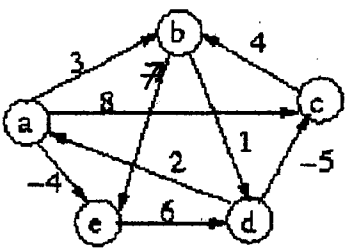
5 a) Define strongly connected components (SCCs) of a graph. Find SCCs of the graph shown below following Kosaraju's algorithm (show detail steps). 14



b) Check whether the graph shown below is an chordal graph or not. 3.5

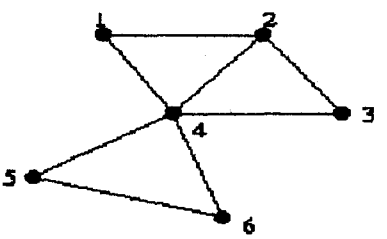


6 a) Describe Floyd-Warshall algorithm to find all-pairs shortest paths (distances). Show the execution steps of this algorithm on the graph shown below: 14



b) If G is a simple graph with 6 vertices and 2 connected components, then find the maximum number of edges in G. 3.5

7 a) Define clique matrix. Find clique matrix of the following graph. Check whether it is an interval graph or not (from its clique matrix). 7



b) Define the properties of following with examples.
(i) Triangulated graph, (ii) Comparability graph, (iii) Permutation graph. 10.5