



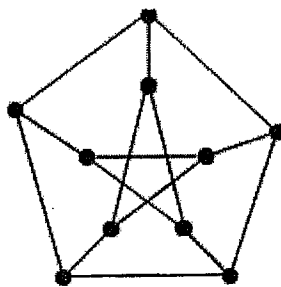
Uva Wellassa University, Sri Lanka
End Semester Examination – February 2011
CST 442-2 Graph Theory
Time: Two (02) hours



Total four (04) Questions
Answer all questions

[01]

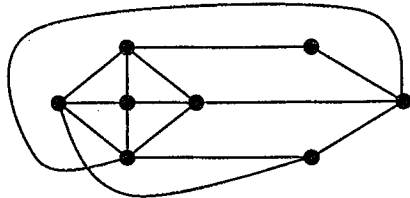
(a) Write down the adjacency matrix and incidence matrix for the following graph:



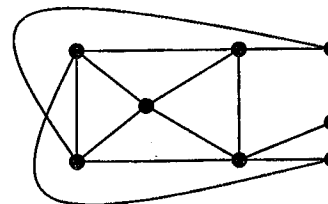
H

[6 marks]

(b) Determine whether the following pair of graphs is isomorphic:



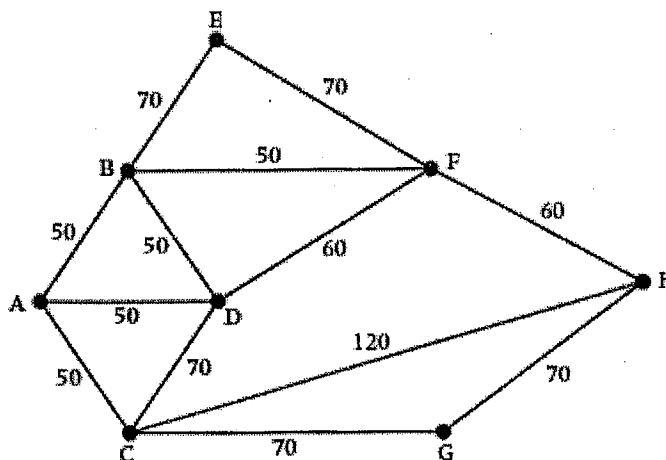
G



G*

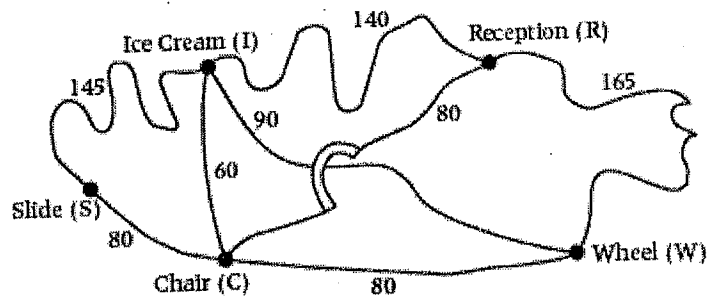
[4 marks]

(c) Find the shortest path from A to H in the following graph:



[8 marks]

- (d) A theme park employs a student to patrol the paths and collect litter. The paths that she has to patrol are shown in the following diagram, where all distances are in meters. The path connecting I and W passes under the bridge which carries the path connecting C and R.

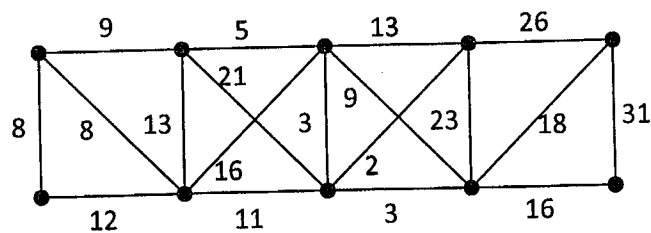


- i. Find an optimal Chinese postman route that the student should take if she is to start and finish at Reception (R). [5 marks]
- ii. State the length of your route. [2 marks]

[02]

- (a)
 - i. Define the term *Spanning tree* for a connected graph. [4 marks]
 - ii. Perform a breath first search and a depth first search for the Peterson graph [8 marks]

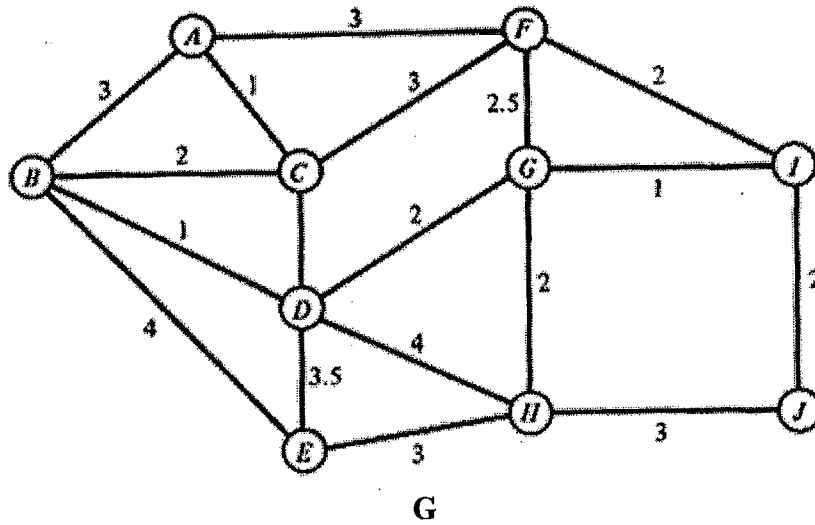
- (b) Let G be the weighted graph given below. Find a minimum weighted spanning tree T of G using Kruskal's algorithm.



G

[5 marks]

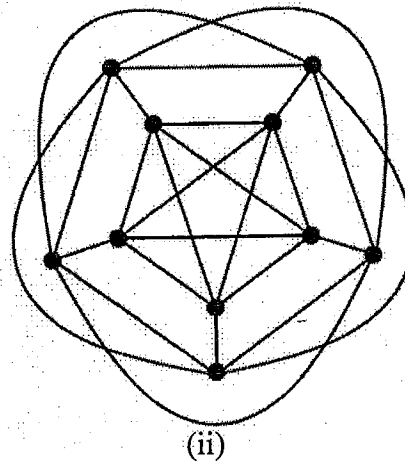
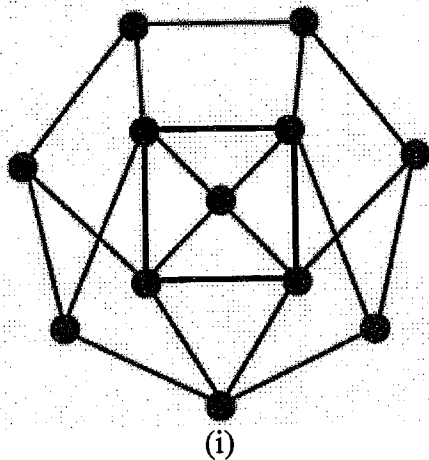
(c) Find the minimum weighted spanning tree for the graph " $G \setminus A$ " using Prime's algorithm, where the graph " $G \setminus A$ " is obtained by deleting the vertex A from the following graph G:



[8 marks]

[03] (a)

- i. Let G be a simple graph. Define k-coloring of G and the chromatic number of G.
- ii. Find the chromatic number for the following graphs:



[10 marks]

- (b) The Animal Care Corporation has decided to start a new zoo with animals that have been displaced or abandoned. The corporation has let the animals to roam freely in the land it has acquired. However, the corporation knows that there should be some enclosures because some of the animals like to feast on some of the others! The corporation has seven types of animals: baboons, foxes, goats, lions, porcupines, rabbits and zebras. Baboons like to feast upon goats and rabbits. Foxes are known to eat goats, porcupines, and rabbits. Lions eat goats and zebras. Porcupines feast on rabbit. Rest of the animals eats vegetation. Draw a graph and use vertex coloring to determine how many enclosures will be needed. Which animals would you place in each enclosure?

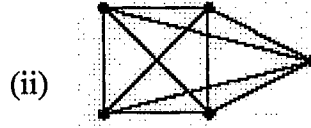
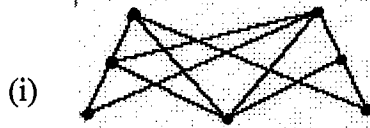
[15 marks]

[04]

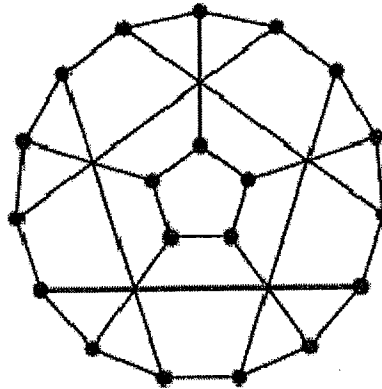
(b) Define the term *planar graph*.

[2 marks]

Determine whether each of the following graphs is planar or not. Justify your answers



(iii)



[9 marks]

(b)

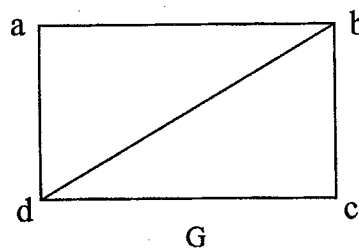
i. Define a line graph $L(G)$ of a graph G .

[2 marks]

ii. Prove that $K_{1,3}$ is not a line graph.

[6 marks]

(c) Draw the graphs $S_2(G)$, $L^2(G)$ and $L_2(G)$ of the following graph:



[6 marks]