…nd … Science … Technology University … Dinajpur

Department of Computer Science and Engineering (CSE)

B. Sc. in Computer Science and Engineering (BSc CSE)

Semester Final Examination 2017(Jul-Dec)

Level 4 Semester II, Course Code: CSE 459, Credit: 3.0

Course Title: Graph Theory

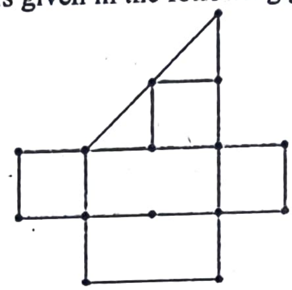
Time: 03 hours — Total Marks: 90

[N.B. The figure in the right margin indicates the marks allocated for respective question. Split answer of any question is not allowed.]

Section-A

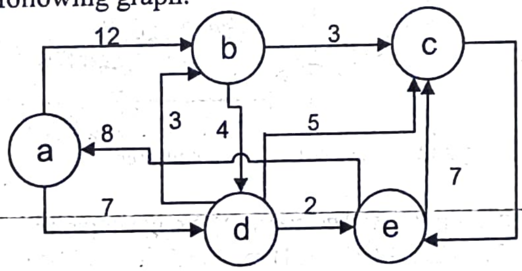
(Answer any 03(three) from the following questions)

1. a) Define the terms: simple graph, complete graph, sub-graph, regular graph and star graph. 5
   b) Write the application of graph theory. 4
   c) A possible floor plan for a museum is given in the following graph. 2+2



   i) Can you find an Euler tour? If not then correct the floor plan for this purpose.
   ii) Can you find a Hamiltonian cycle? If not then correct the floor plan for this purpose.
   d) What does it mean for two graphs G1 and G2 to be isomorphic? Show an example. 1+1

2. a) What is connected component and k-edge connected? Draw a graph with 3 connected components. 2+2
   b) Using Dijkstra's algorithm, find the length of shortest path from the source vertex '~~S~~' a to each of the other vertices of the following graph. 9



   c) Differentiate between walk and path. 2

3. a) What is complete bipartite graph? Give an example. 2+1
   b) Define tree and spanning tree. Write the properties of a tree. 2+2
   c) What is duality? Write the characteristic of dual graph. 2+3
   d) Proof the theory, "A graph G is planar if and only neither K_5 nor $K_{3,3}$ is a minor of G".. 3

4. a) Define planar graph, tournament graph and face with example. 6
   b) Draw a planner graph with five faces. 3
   c) Prove the following theory with a suitable example. 6
   "*If a connected graph has planner embedding then* $v - e + f = 2$"
   Where v is the number of *vertices*, e is the number of *edges* and f is the number of *faces*.

Section-B

*(Answer any **03(three)** from the following questions)*

1. a) Let G = (V, E) be a graph. Define any five from the following terms with example. 5

i.	Trail	iii.	Euler trail	v.	Hamiltonian cycle
ii.	Cycle	iv.	Euler tour	vi.	Hamiltonian path

b) Give an example of a graph which is 6

i) Eulerian trail but not Eulerian tour.
ii) Hamiltonian cycle but not Eulerian tour.
iii) Eulerian tour but not Hamiltonian cycle.

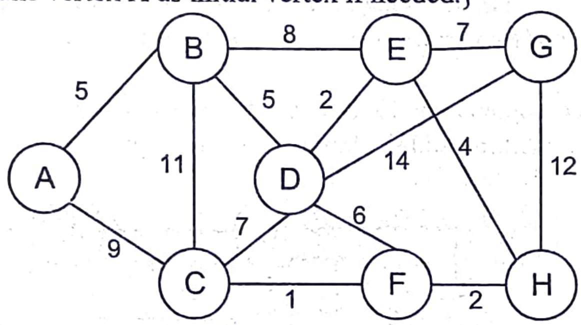
c) True or false: If a graph is bipartite then it is 2-colorable. Justify your answer. 2

d) Draw the graph having following matrix as its adjacency matrix. 2

$$\begin{pmatrix} 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 \end{pmatrix}$$

2. a) Define dual graph with an example. 3

b) What is a Minimum Spanning Tree (MST)? Find the MST of the following graph using Prims or Kruskal's algorithm. {Take vertex A as initial vertex if needed.} 2+8



c) True or false: MST is always unique. Justify your answer. 1+1

3. Consider the network flow problem with the following edge capacities, c(u, v) for edge (u, v): c(s,2)=2, c(s,3)=13, c(2,5)=12, c(2,4)=10, c(3,4)=5, c(3,7)=6, c(4,5)=1, c(4,6)=1, c(6,5)=2, c(6,7)=3, c(5,t)=6, c(7,t)=2

a) Draw the network. 3
b) Find the maximum flow by using the Ford-Fulkerson algorithm also show each residual graph. 9
c) Show the minimum cut. 3

4. a) Define chromatic number. 2

b) Prove the theory, "A graph with maximum degree at most k is (k+1) colorable." 5

c) A group of eight CSE students plans to take part in special repeated exams in the courses C_1, C_2, C_3, C_4, C_5 *and* C_6 as follows:

Student1: C_1, C_3	Student3: C_2, C_6	Student5: C_3, C_4	Student7: C_5, C_6
Student2: C_1, C_4, C_5	Student4: C_2, C_3, C_6	Student6: C_3, C_5	Student8: C_1, C_5

i) Now, schedule the exam by using coloring graph theory and consider that, a student can take only one test during a particular time slot. 5
ii) Determine the chromatic number of this problem. 1
iii) What does this number tell us in this case? 2