

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), November - December 2017

B. Tech. (CSE), Semester V

Roll No.....

CSE 524: GRAPH THEORY

Time: 3 hours

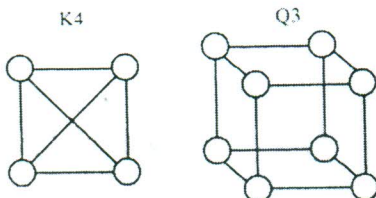
Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.

Q.1 Choose the correct answer for the following problems (10 questions @ 1 mark) 10

- i. In a connected graph, a bridge is an edge whose removal disconnects a graph. Which one of the following statements is true?
(a) A tree has no bridge
(b) A bridge cannot be part of a simple cycle
(c) Every edge of a clique with size ≥ 3 is a bridge (A clique is any complete subgraph of a graph)
(d) A graph with bridge cannot have a cycle
- ii. The maximum number of edges in a bipartite graph on 12 vertices is;
(a) 12 (b) 6 (c) 36 (d) 24
- iii. A cycle on n vertices is isomorphic to its complement. The value of n is;
(a) 3 (b) 4 (c) 5 (d) 7
- iv. K_4 and Q_3 are graphs with the following structures.



Which one of the following statements is TRUE in relation to these graphs?

- (a) K_4 is planar while Q_3 is not (b) Both K_4 and Q_3 are planar
(c) Q_3 is planar while K_3 is not (d) Neither K_4 nor Q_3 is planar
- v. In a binary tree with n nodes, every node has an odd number of descendants. Every node is considered to be its own descendant. What is the number of nodes in the tree that have exactly one child?
(a) 0 (b) 1 (c) $(n - 1) / 2$ (d) $n - 1$
- vi. What is the chromatic number of an n -vertex simple connected graph which does not contain any odd length cycle? Assume $n \geq 2$;
(a) 2 (b) 3 (c) $n - 1$ (d) n
- vii. If for some positive integer k , $\deg(v) = k$ for each vertex v of a graph G , G is;
(a) k -complete graph (b) k -regular graph
(c) k -bipartite graph (d) tree
- viii. Length Right sub-tree, root, Left sub-tree of a walk in a graph G is;
(a) Total number of edges in G (b) Total number of edges in walk

- (c) Total number of vertices in G (d) Total number of vertices in wak
- ix. Which indicates pre-order traversal?
- Left sub-tree, Right sub-tree and root
 - Right sub-tree, Left sub-tree and root
 - Root, Left sub-tree, Right sub-tree
 - Right sub-tree, root, Left sub-tree
- x. In an undirected graph, the number of vertices with odd degree is;
- odd
 - even
 - zero
 - prime

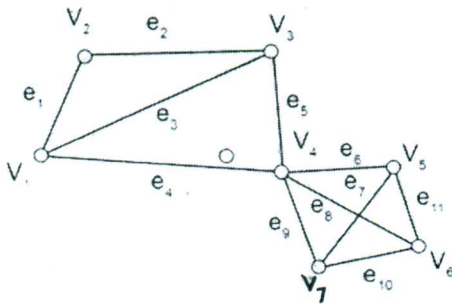
Q.2 Solve the following problems (4 questions @ 2.5 marks)

10

- Prove that the sum of the degrees of the vertices of any finite graph is even.
- G is an undirected graph with n vertices and 25 edges such that each vertex of G has degree atleast 3. Find the maximum possible value of n ?
- Write down any 2 application areas where concept of planar graphs can be applied. Explain how this concept is used in those areas?
- Explain rooted tree and all the terms associated with it. Under what condition, a rooted tree is called m -ary tree.

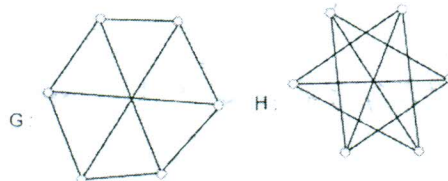
Q.3A Find the adjacency matrix and incidence matrix for the following graph.

05



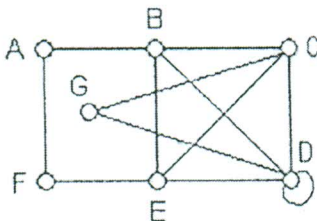
Q.3B State with justification, whether the following two graphs are isomorphic.

05



Q.4A Does an Euler circuit exist on the graph below? Explain in detail.

05

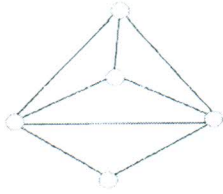


Q.4B Explain the following by taking suitable examples.

05

- Bipartite graph
- Union of two graphs

Q.5A Draw the dual of the following graph G and check whether G is self-dual. 05



Q.5B State Königsberg bridge problem and use the concept of graph theory to find its answer. 05

Q.6A Write a short note on the following. 05

- a) Abstract dual graphs
- b) Planar graphs

Q.6B State Euler's formula. A connected planar graph has 10 vertices each of degree 3. Into how many regions, does a representation of this planar graph split the plane? 05

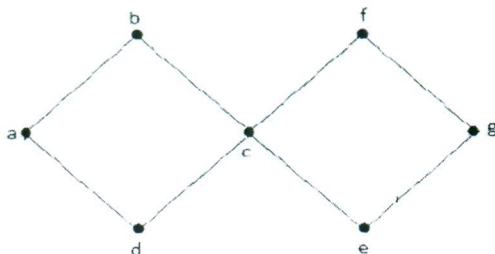
Q.7A Suppose that a tree T has N_1 vertices of degree 1, N_2 vertices of degree 2, N_3 vertices of degree 3, ..., N_k vertices of degree k, prove that:
 $N_1 = 2 + N_3 + 2N_4 + 3N_5 + \dots + (k-2)N_k$. 05

Q.7B Use a binary tree to represent the following expressions. 05

- (i) $(a + b) * (c / d)$
- (ii) $((a + b) * c) + (d / e)$

OR

Q.7B Use BFS algorithm to find a spanning tree of the following graph G. 05



Q.8A Explain the difference of one with another in the following. 05

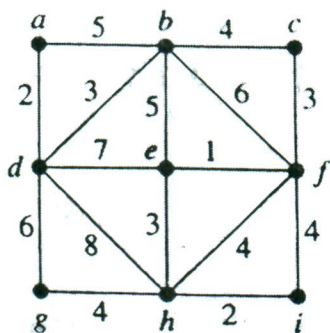
- a) Edge connectivity and vertex connectivity
- b) Euler Graph and Hamiltonian Graph

Q.8B If $G = (V, E)$ is a graph with highest degree $\Delta(G)$, then $\chi(G) \leq \Delta(G) + 1$, where $\chi(G)$ is the chromatic number of G. 05

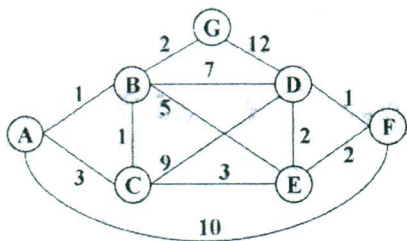
OR

Q.8B Find the chromatic number and chromatic polynomial for the complete bipartite graph $K_{3,3}$. 05

- Q.9A Find the minimum spanning tree for the following graph using Prim's algorithm. 10



- Q.9B Consider the following undirected, weighted graph: 10



Step through Dijkstra's algorithm to calculate the single-source shortest paths from A to every other vertex. Finally, indicate the lowest-cost path from node A to node F.

OR

- Q.9B Using graph theory, how can the final exams at a University be scheduled so that no student has two exams at the same time with the condition that there are some students who would appear in the examination of two or more courses? Justify your answer by scheduling 7 final exams. 10