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H-5326

M.A./M.Sc. (Semester-II)

Examination July, 2022

MATHEMATICS

(Advanced Discrete Mathematics-II)

Time Allowed : Three Hours

Maximum Marks : 70

Minimum Passing Marks : 25

Note : Attempt questions from all four sections as directed.

Distribution of marks is given with each sections.

SECTION-A

(Objective Type Questions)

Note : Attempt **all** questions of this section. Each question carries **1** mark. [1x10=10]

1. (A) Fill in the blanks :

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(1)

[P.T.O.]

- (i) A path is called path if no vertex repeated more than once in the path.
- (ii) A spanning tree is also called tree subgraph.
- (iii) Dijkstra algorithm is use to obtain the path from a specified vertex to another specified vertex.
- (iv) Any instant of time, a finite state machine is in
- (v) A finite state automata is denoted by quintuple.....
- (B) Multiple Choice question :
- (vi) A complete graph $K_{m,n}$ is planar if :
 - (a) $m < 3$ or $n \leq 3$
 - (b) $m \leq 3$ or $n < 3$
 - (c) $m < 3$ or $n < 3$
 - (d) $m > 3$ or $n > 3$
- (vii) A vertex-edge incidence matrix is :
 - (a) Incidence matrix
 - (b) Incidence adjacency matrix

- (c) Incidence adjacency lists matrix
- (d) Incidence reverse star matrix
- (viii) The process of visiting and performing some computation of each vertex of a tree is called :
 - (a) Search Tree
 - (b) Undirected Graph
 - (c) Tree Traversals
 - (d) Weighted
- (ix) Two states S_i and S_j of a machine are said to be 0-equivalent if the states S_i and S_j have the :
 - (a) $S_i \neq 0$ but $S_j = 0$
 - (b) $S_i = 0$ but $S_j \neq 0$
 - (c) Same output
 - (d) Both (a) and (b)
- (x) In subgraph, $G = (V, E)$ is :
 - (a) directed or undirected
 - (b) cut set or cycle

(c) path or circuit

(d) planar

SECTION-B

(Very Short Answer Type Questions)

Note : Attempt **any five** questions. Each question carries **02** marks. (Word limit **25-30** words) [5x2=10]

2. Define the following terms :

(i) Undirected graph

(ii) Planar graph

(iii) Dijkstra's Algorithm

(iv) Fundamental Cut-sets

(v) Strong Connectivity

(vi) Finite State machines

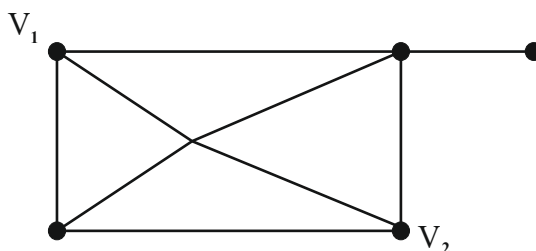
(vii) Finite Automata

SECTION-C

(Short Answer Type Questions)

Note : Attempt **any five** questions. Each question carries **04** marks. (Word limit 250 words) [5x4=20]

3. (i) Prove that the sum of the degrees of all vertices in a graph G is equal to twice the number of edges in G .
- (ii) Show that every connected graph has at least one spanning tree.
- (iii) List all cut-sets with respect to the vertices V_1 , V_2 in the graph :



- (iv) Construct a finite state machine M that recognizes the set of strings of 0s and 1s in each of which the number of 0s is even and number of 1s is a multiple of 3.
- (v) Draw a NFA that accepts all inputs with 011 in them over $I = \{0, 1\}$
- (vi) Design a turing machine that completes the function :

$$f(x) = \begin{cases} x + y, & \text{if } x \geq y \\ 0, & \text{if } x < y \end{cases}$$

- (vii) Draw the graphs represented by the following adjacency matrix :

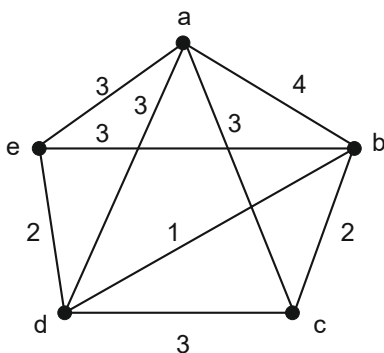
$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

SECTION-D

(Essay Type Questions)

Note : Attempt **any three** questions. Each question carries **10** marks.(more that 500 words) [3x10=30]

4. (i) State Kuratowski's theorem and write it use.
- (ii) Find the minimum spanning tree for the following weighted graph :



- (iii) Define with examples of the following :
- (a) Mealy machine
 - (b) Moore Machine
- (iv) Give an example of bipartite graph and prove that a graph is bipartite if and only if it contains no circuit of odd length.

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