Total No. of Questions : 8] *[Total No. of Printed Pages : 3*

Roll No ....

MCADD-102

M.C.A. (Integrated), I Semester

Examination, June 2020

Discrete Mathematics

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) If A, B, C are any three sets then P.T.

   i) $A-(B\cup C)=(A-B)\cap(A-C)$

   ii) $A\times(B\cup C)=(A\times B)\cup(A\times C)$

   b) For the two mapping $f:R\to R$ defined by $f(x)=x^2\,\forall x\in R$, and $g:R\to R$ defined by $g(x)=\sin x\ \forall x\in R$. Then show that $(g\circ f)(x)\neq(f\circ g)(x)$.

2. a) Let A = {1, 2, 3}, B = {a, b, c} and C = {x, y, z} be three sets. Let R and S be the relations from A to B and B to C perfectively defined by

   R = {(1, b), (2, a), (2, c)} and

   S = {(a, y), (b, x), (c, y), (c, z)} then find matrices M_R, M_S and M_{SOR}.

   b) Prove that $5^{2n}-1$ is divisible by 24, where n is any positive integer.

3. a) i) Prove that $p \wedge q \Rightarrow q \vee p$ is a tautology.

   ii) Show that $(p \vee q) \wedge (\sim p) \wedge (\sim q)$ is a contradiction.

   b) Explain the following terms and give examples also.
   i) Quantifiers
   ii) Universal quantifiers
   iii) Existential quantifiers
   iv) Negation of a Quantifiers

4. a) Draw a circuit for the following Boolean function and replace it by a simple one:

   $$F(x, y, z) = x \cdot z + \left[y \cdot (y' + z) \cdot (x' + x, z') \right]$$

   b) If $f : x \rightarrow y$ and A, B are two subsets of Y, then prove

   $$f^{-1}(A \cup B) = f^{-1}(A) \cup f^{-1}(B)$$

5. a) Solve by Gauss-elimination method
   $x + 2y + z = 8$
   $2x + 3y + 4z = 20$
   $4x + 3y + 2z = 16$

   b) Find the rank of a matrix.

   $$A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{pmatrix}$$

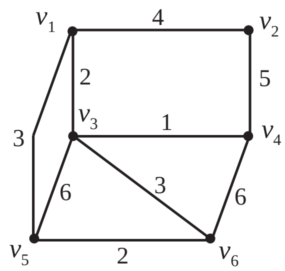
6. a) Explain the following.
   i) Euler Graph
   ii) isomorphic graphs
   iii) Minimal spanning tree
   iv) Height of the tree

b) Prove that in any graph G, even number of vertices are of odd degree.

7. a) Draw the graph whose incidence matrix A is given by

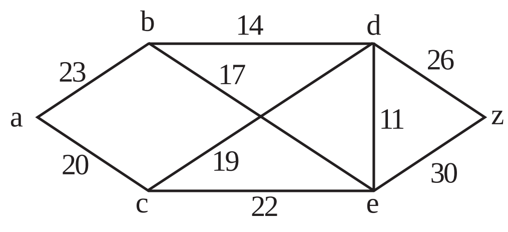
$$A = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{array} \begin{array}{c} \begin{array}{cccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

b) Find the minimal spanning tree for the weighted graph.



8. a) State and prove that Euler's theorem on graphs.

b) Find the shortest path between a and z in the graph shown below.



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