No. of Printed Pages—3

48 (DS)

[18–HRGPKAC–M3S]

MCA/MSc IT 3rd Semester Exam., 2018

DISCRETE MATHEMATICS

[MCA/MSc IT (S3) 09]

Full Marks : 80

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer any *five* from the following questions : 2×5=10

(a) Define one to one and onto function.

(b) When a proposition is called a tautology?

(c) Write the types of quantifiers.

(d) Find the identity element of a group of integers with binary operation defined by $a * b = a + b + 2$.

(e) Define the degree of a vertex.

(f) Write down the truth table of Biconditional.

2. Answer any *three* from the following questions : 4×3=12

(a) Let

$A = \{1, 2, 3, 4, 5, 6\}$

$B = \{1, 4, 9, 16, 25, 36\}$

$R = \{(1, 1), (2, 4), (3, 9), (4, 16), (5, 25), (6, 36)\}$

Find the relation matrix M_R and relation graph G_R. 2+2=4

(b) Define Boolean Algebra. Give two examples of Boolean Algebra. 2+2=4

(c) Define a directed graph. Find the directed graph that has the adjacency matrix

$$A = \begin{array}{c} \\ a \\ b \\ c \\ d \end{array} \begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 1 & 0 & 1 & 2 \\ 0 & 0 & 1 & 0 \\ 0 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

1+3=4

(d) Define permutation. Find the number of permutations from the letters of the word MISSISSIPPI. 1+3=4

3. Answer any *three* from the following questions : 6×3=18

(a) If an integer is divisible by 10, then it is divisible by 2. If an integer is divisible by 2, then it is divisible by 3. Prove that an integer divisible by 10 is divisible by 3.

(b) In how many ways can the letters of the word EQUATION be arranged—

(i) with the vowels only in the odd places;

(ii) beginning and ending with vowels;

(iii) beginning and ending with consonants? 2+2+2=6

(c) Write a necessary and sufficient condition for a subset to be a subgroup. Prove that the intersection of two subgroups is a subgroup. 2+4=6

(d) Define compositions of function. Prove that $h \circ (g \circ f) = (h \circ g) \circ f$ 2+4=6

4. Answer any *four* from the following questions : 10×4=40

(a) Let

p : Ravi is rich.

q : Ravi is happy.

Write simple verbal sentences which describes each of the following statements : 1×10=10

(i) $p \vee q$

(ii) $p \wedge q$

(iii) $q \rightarrow p$

(iv) $p \vee \sim q$

(v) $q \leftrightarrow p$

(vi) $\sim p \rightarrow q$

(vii) $\sim \sim p$

(viii) $(\sim p \wedge q) \rightarrow p$

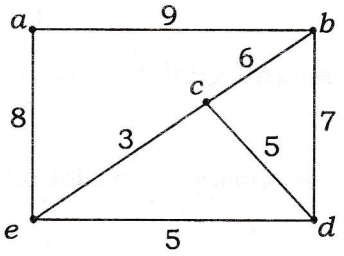
(ix) $\sim q \rightarrow \sim p$

(x) $\sim (p \vee q)$

(b) State the principle of inclusion and exclusion. In a classroom, there are 22 students, out of these 8 study Mathematics, 11 study Physics and 12 study Computer Science. Also, 4 study Mathematics and Physics, 5 study Mathematics and Computer Science and 7 study Physics and Computer Science. 2 students in the class study all three subjects. How many of these students study none of the three subjects? 2+8=10

(c) Define rule of inference. Describe the rules of inference. 2+8=10

(d) Define a spanning tree. Describe Kruskal's algorithm to obtain the optimal spanning tree. Find minimal spanning trees that can be obtained using Kruskal's algorithm from the following figure : 10



(e) Define lattice. Draw the Hasse diagram for $(X, \leq)$ where $X = \{2, 3, 6, 12, 24, 36\}$ and $x \leq y$ if $x \mid y$. Describe two types of lattices. 2+4+4=10

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