CBCS Scheme

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16/17MCA15

First Semester MCA Degree Examination, June/July 2018

Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define :
i) proposition
ii) logical equivalence.
Show that the compound propositions : $[p\wedge(\sim q\vee r)]$ and $[p\vee(q\wedge\sim r)]$ are not logically equivalent. **(06 Marks)**

b. Prove that for any propositions p, q, r the compound proposition.
$[(p\vee q)\wedge\{(p\rightarrow r)\wedge(q\rightarrow r)\}]\rightarrow r$, is a tautology . **(05 Marks)**

c. Give a direct proof of the statement "The square of an odd integer is an odd integer". **(05 Marks)**

OR

2 a. For any propositions p, q, r verify the distributive laws :
i) $p\wedge(q\wedge r)\Leftrightarrow(p\vee q)\wedge(p\vee r)$
ii) $p\wedge(q\vee r)\Leftrightarrow(p\wedge q)\vee(p\wedge r)$. **(06 Marks)**

b. Without constructing the truth table simplify the following logical statement.
$(p\vee q)\wedge[\sim\{(\sim p)\wedge q\}]$. **(05 Marks)**

c. Negate and simplify each of the followings :
i) $\exists x, [p(x)\vee q(x)]$
ii) $\forall x, [p(x)\wedge\sim q(x)]$
iii) $\forall x, [p(x)\rightarrow q(x)]$
iv) $[\exists x\,[p(x)\vee q(x)]\rightarrow r(x)$. **(05 Marks)**

Module-2

3 a. Define a power set. Prove that for a finite set S, has n-elements and its power set has 2^n–elements. **(06 Marks)**

b. Define Relative. Compliment (difference of two sets) of two sets A and B. For any three non–empty sets A, B, C prove that $A\cup(B\cap C)=(A\cup B)\cap(A\cap C)$. **(05 Marks)**

c. Let R be a relation on the set A = {1, 2, 3, 4} defined by xRy is 'x divides y'. Prove that (A, R) is a Poset. Draw its Hasse diagram. **(05 Marks)**

OR

4 a. In a sample of 100 logic chips, 23 have a defect D_1, 26 have defect D_2, 30 – have a defect D_3, 7 have defect D_1 and D_2, 8 – have defects D_1 and D_3, 10 have defects D_2 and D_3 and 3 – have all the three defects. Find the number of chips having i) at least one defect ii) no defect. **(05 Marks)**

b. Define one-one and onto functions. Let $f: z \to z$ be defined by $f(a) = a + 1 \ \forall a \in z$, find whether f – is one-one, onto or both. **(05 Marks)**

c. Let A = {1, 2, 3, 4}

R = {(1, 1), (1, 2), (2, 3), (2, 4), (3, 4), (4, 1), (4, 2)}

S = {(3, 1), (4, 4), (2, 3), (2, 4), (1, 1), (1, 4)}

Write he relation matrices of : i) M_R ii) M_S iii) M(RoS) iv) M(SoR). **(06 Marks)**

Module-3

5 a. State Pigeon–hole principle. ABC – is an equilateral triangle whose sides are of length 1cm, if we select 5-points inside the triangle, prove that at least two of these points are such that the distance between them is less than ½cm. **(05 Marks)**

b. Find the number of permutations of the letters of the word INSTITUTION :
   i) How many begin with I
   ii) How many of these begin with I and end with N?
   iii) In how many words are the three T's are together? **(06 Marks)**

c. A bank pays 6% on savings compounding the interest annually. If a person deposits Rs. 1000/- on the first day of the May. How much will this deposit be worth after a year? **(05 Marks)**

OR

6 a. Among the integers 1 to 200, determine the number of digits that are :
   i) Divisible by 2 or 5 or 9
   ii) Not divisible by 2 or 5 or 9
   iii) Not divisible by 5. **(06 Marks)**

b. Find the coefficient of x^4y^5 in the expansion of $(2x - 3y)^9$. **(05 Marks)**

c. The sequence $\{a_n\}$ – is defined by recursively $a_1 = 4$, $a_n = a_{n-1} + n$ for $n \geq 2$. Find $\{a_n\}$ in explicit form. **(05 Marks)**

Module-4

7 a. Define :
   i) Mutually exclusive events
   ii) Conditional probability
   iii) Mutually independent events. **(05 Marks)**

b. A problem is given to four students A, B, C and D whose chances of solving it are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$ respectively. Find the probability that the problem is solved. **(06 Marks)**

c. For any three events A, B, C prove that :

$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$. **(05 Marks)**

OR

8 a. If A and B are events with $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, $P(A \cap B) = \frac{1}{4}$, find $P(A|B)$ $P(B|A)$, $P(\overline{A} \mid \overline{B})$, $P(\overline{B} \mid \overline{A})$. **(06 Marks)**

b. Define event and sample space, hence prove that $P(A) + P(\overline{A}) = 1$. A – is any event. **(05 Marks)**

c. A husband and wife appear for an interview for two vacancies in the same post. The probability of husband's selection is $\frac{1}{7}$ and that of wife's selection is $\frac{1}{5}$. what is the probability that i) Both of them will be selected ii) only one of them selected iii) none of them selected. **(05 Marks)**

Module-5

9 a. Define the terms with one example for each :
i) Complete graph
ii) matrix representation of graphs
iii) incidence matrix of graph. **(06 Marks)**

b. Find the number of vertices, the number of edges and the degree of each vertex in the following undirected graph in Fig.Q9(b). **(05 Marks)**

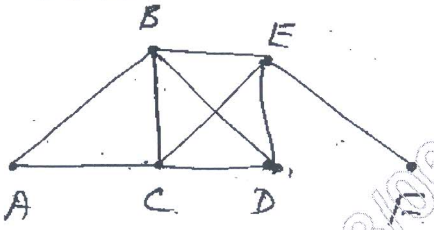

Fig.Q9(b)

c. Define Bipartite graph, with an example. How many edges the graph K_{36} contain. **(05 Marks)**

OR

10 a. Define subgraph and spanning subgraph. **(06 Marks)**

b. Determine whether the graphs shown in Fig.Q10(b) are isomorphic. **(05 Marks)**

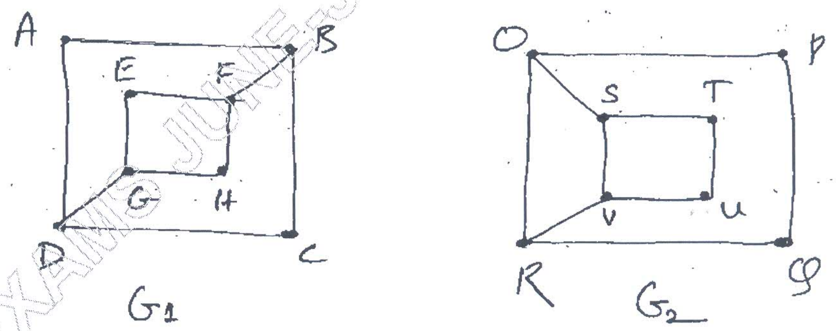

Fig.Q10(b)

c. Explain Konigsberg bridge problem. **(05 Marks)**

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