

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 :
- proposition
 - 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 :
- $p \wedge (q \wedge r) \Leftrightarrow (p \wedge q) \wedge (p \wedge r)$
 - $p \wedge (q \vee r) \Leftrightarrow (p \wedge q) \vee (p \wedge r)$. (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 :
- $\exists x, [p(x) \vee q(x)]$
 - $\forall x, [p(x) \wedge \sim q(x)]$
 - $\forall x, [p(x) \rightarrow q(x)]$
 - $[\exists x [p(x) \vee q(x)] \rightarrow r(x)]$. (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 $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$. (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 $f: z \rightarrow z$ 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 the relation matrices of: i) M_R ii) M_S iii) $M(R \circ S)$ iv) $M(S \circ R)$. (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 $\frac{1}{2}$ cm. (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 $P(A|B)$, $P(B|A)$, $P(\bar{A} | \bar{B})$, $P(\bar{B} | \bar{A})$. (06 Marks)
- b. Define event and sample space, hence prove that $P(A) + P(\bar{A}) = 1$. 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)

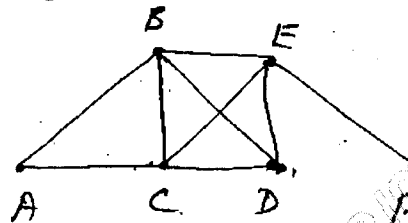


Fig.Q9(b)

- 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)

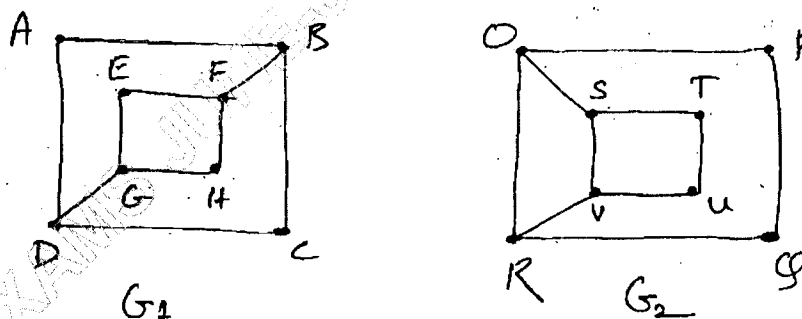


Fig.Q10(b)

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