

# CBCS Scheme

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16MCA15

## First Semester MCA Degree Examination, June/July 2017 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. Prove that for any three propositions P, Q and R without truth tables:  
 $(\sim P \wedge (\sim Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \leftrightarrow R$  (03 Marks)
- b. Obtain the principle of conjunctive normal form of  $(\sim P \rightarrow R) \wedge (Q \leftrightarrow P)$ . (03 Marks)
- c. If P and Q are propositions for which  $P \rightarrow Q$  is false determine the truth values of:  
i)  $(P \wedge Q)$     ii)  $\sim P \vee Q$     iii)  $Q \rightarrow P$     iv)  $\sim Q \rightarrow \sim P$  (10 Marks)

OR

- 2 a. Discuss different types of logical connectives with example and truth table. (08 Marks)
- b. For establishing the validity of arguments, briefly explain different types of rules of inference. (08 Marks)

### Module-2

- 3 a. Prove that for any 3 sets A, B and C,  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ . (04 Marks)
- b. If A and B are any two sets, prove that  $A - B = A - (A \cap B)$ . (04 Marks)
- c. Among 100 students, 32 literature, 20 study cycology, 45 study economics, 15 study literature and economics, 7 study literature and cycology, 10 study cycology and economics, 30 do not study any of three subjects, find:  
i) The number of students studying all the 3 subjects.  
ii) Number of students studying exactly one of three subjects. (08 Marks)

OR

- 4 a. What is function? Briefly explain different types of functions. (04 Marks)
- b. Let  $A = \{1, 2, 3, 4, 6\}$  and R be a relation on A defined by  $aRb$  if and only if a is a multiple of b. Represent the relation R as a matrix and draw its digraph. (06 Marks)
- c. Consider the partial order of divisibility on the set A. Draw the Hasse diagram of the poset  $A = \{1, 2, 3, 5, 6, 10, 15, 30\}$ . (06 Marks)

### Module-3

- 5 a. If 10 points are selected from the interior of a triangle whose sides are of length 3 cms (each), show that atleast two points are within 1 cm apart. (08 Marks)
- b. If you have 6 new year greeting cards and you want to send them to 4 of your friends, in how many ways can this be done? (04 Marks)
- c. Find the number of subsets of the set  $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$  having 4 elements. (04 Marks)

OR

- 6 a. For all  $n \geq 0$  and  $k \geq 0$ , prove the following:  
i)  $c(n, 0) = 1$     ii)  $c(n, n) = 1$   
iii)  $c(n, k) = c(n, n - k)$     iv)  $c(n, k) = 0$  if  $k > n$  (06 Marks)

- b. Using binomial coefficient solve  $c(4, 2)$ . (04 Marks)
- c. The Ackerman's numbers  $A(m, n)$  are defined recursively for  $m, n \in \mathbb{N}$ .
1.  $A(0, n) = n + 1, n \geq 0$
  2.  $A(m, 0) = A(m - 1, 1)$  for  $m > 0$
  3.  $A(m, n) = A(m - 1, A(m, n - 1))$  for  $m, n > 0$ .
- Prove the following:
- i)  $A(1, n) = n + 2$  for all  $n \in \mathbb{N}$
  - ii)  $A(2, n) = 3 + 2n, n \geq 0$ . (06 Marks)

**Module-4**

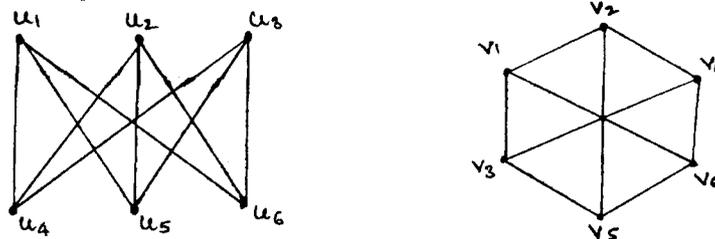
- 7 a. State the Axioms of probability. (03 Marks)
- b. If Charles tosses a coin four times, what is the probability that he gets two heads and two tails? (06 Marks)
- c. Determine the number of positive integers  $n$  where  $1 \leq n \leq 100$  and  $n$  is not divisible by 2, 3 or 5. (07 Marks)

OR

- 8 a. Define: i) probability, ii) conditional probability, with suitable example. (08 Marks)
- b. There are  $n$  letters and  $n$  addressed envelopes. If the letters are placed in the envelopes a random, what is the probability that all the letters are not placed in the right envelopes? (08 Marks)

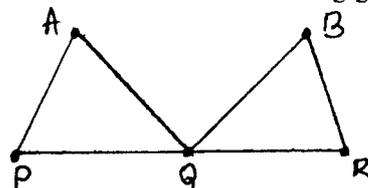
**Module-5**

- 9 a. Define graph. Discuss different types of graph terminology and special types of graphs (08 Marks)
- b. What is isomorphism? Show that the following two graphs are isomorphic. (08 Marks)

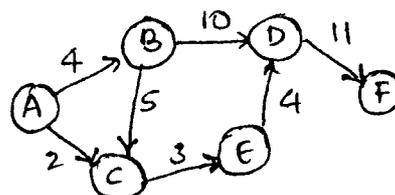


OR

- 10 a. Discuss Euler graphs and show that the following graph is Eulerian.



- b. Define shortest path problem. Using Dijkstra's algorithm find the shortest path for the following graph. (08 Marks)



(08 Marks)

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