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Total No. of Pages: 03

Total No. of Questions: 07

BCA (2011 & Onward) / B.Sc.(IT) (2015 & Onwards) (Sem. – 1)

MATHEMATICS – I

M Code: 10045

Subject Code: BSIT/BSBC-103

Paper ID: [B1110]

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains SIX questions carrying TEN marks each and students have to attempt any FOUR questions.

SECTION A

1. a) If A, B are two sets the prove that $B - A = B \cap A^c$.
- b) Find all the partitions of the set $A = \{a, b, c\}$.
- c) Let $X = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. The family $\{\{1, 4, 8\}, \{3, 5, 9\}, \{2, 7\}, \{6, 10\}\}$ is a partition of X. Determine the equivalence relation corresponding to the above partition.
- d) Let $B = \{2, 3, 4, 6, 12, 36, 48\}$ and S be the relation “divide” on B, Draw Hasse diagram of the relation S.
- e) Using truth table, prove that $p \rightarrow q = (\sim p) \vee q$.
- f) If p stands for the statement “I do not like chocolates” and q for the statement “I like ice-cream”, then what does $\sim p \wedge q$ stands for?
- g) Show that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$.
- h) Give an example of a graph that has
 - a) Euler circuit but not Hamiltonian circuit.
 - b) Hamiltonian circuit but not Euler circuit.
- i) Obtain the linear recurrence relation from the sequence defined by $S(K) = 5.2^K$.
- j) Solve the recurrence relation $a_n - 7a_{n-1} + 10a_{n-2} = 0$, given by $a_0 = 0, a_1 = 3$.

SECTION B

2. State and prove De Morgan's Laws for sets.

For where $\frac{a}{b}, \frac{c}{d} \in Q$, where Q is the set of rational numbers, define a relation R as $\frac{a}{b} R \frac{c}{d}$ if and only if $ad = bc$. Show that R is an equivalence relation on Q .

3. a) Let $A = \{2, 3, 5, 8\}$, $B = \{4, 6, 16\}$, $C = \{1, 4, 5, 7\}$. Let $R = \{(a, b) : a/b\}$ and $S = \{(b, c) : b \leq c\}$ be relations from A to B and B to C . Find the composite relation $S \circ R$. If L , M and N be the adjacency matrices of $S \circ R$, R and S respectively. Then show that $L = M.N$.

- b) Check the validity of argument:

If I work, I cannot study. Either I work or pass mathematics.

I passed mathematics. Therefore, I study.

4. a) Over the universe of Books, define the proposition $B(x)$: x has a blue cover, $M(x)$: x is a mathematics book, $U(x)$: x is published in United States and $R(x, y)$: The bibliography of x includes y .

Translate into words:

- i) $(\exists x)(M(x) \wedge \sim B(x))$.
- ii) $(\forall x)(M(x) \wedge U(x) \rightarrow B(x))$
- iii) $(\exists x)(\sim B(x))$

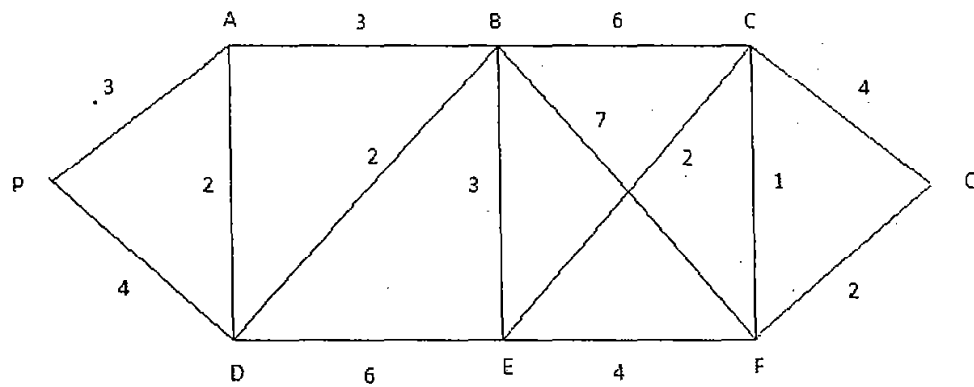
Express using quantifiers:

- iv) Every book with blue cover is a mathematics book.
- v) There are mathematics books that are published outside the United States.
- vi) Not all books have bibliography.

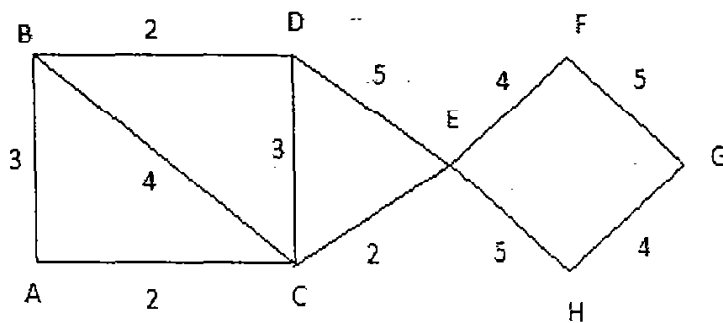
- b) Use the principle of mathematical induction to prove

$$1.3 + 2.4 + 3.5 + \dots + n(n+2) = \frac{n(n+1)(2n+7)}{6}, \text{ for any natural number } n.$$

5. Using Dijkstra's Algorithm, find shortest path from P to Q



6. a) Find the minimal spanning tree for the following weighted connected graph using Kruskal's Algorithm.



- b) Solve $S(K) - 8S(K - 1) + 16S(K - 2) = 0$, where $S(2) = 16$, $S(3) = 80$.
7. a) Solve $S(K) - 3S(K - 1) - 4S(K - 2) = 4^K$.

- b) Find inverse of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 5 \\ 1 & 3 & 4 \end{bmatrix}$