

B.Sc.IT: Semester – III [Logic and Discrete Mathematics]
Question Paper (April – 2015) [Revised Course]

- Kamal T.

Time: 3 Hours

Total Marks: 100

N.B.: (1) All Questions are Compulsory.

(2) Part a is compulsory and attempt any one sub question from part b and c from Q. 2 TO Q. 7.

(3) Figure to right indicate full marks.

Q.1 Attempt any one of The Question: (10 Marks)

- (A) Using Venn diagram, show that (10)
(i) $(A \cup B)' = A' \cap B'$ (ii) $(A \cap B)' = A' \cup B'$
- (B) Describe the graphs giving one example each. (10)
(i) Regular Graph (ii) Bipartite Graph

Q.2 Attempt The Following questions: (15 Marks)

- (A) Show that $(p \Leftrightarrow q) \Leftrightarrow (\sim q \Rightarrow \sim p)$ using truth tables. (8)
- (B) Using first principle of finite induction prove that (7)
 $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$.
- (C) State principle of inclusion and exclusion for three sets. Further, find number of (7)
integers between 1 to 400 that are not divisible by 2, 3 and 5.

Q.3 Attempt The Following questions: (15 Marks)

- (A) Using Warshall's Algorithm find the matrix of the transitive closure for relation R (8)
defined on set $A = \{1, 2, 3, 4\}$ by the matrix
- $$\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$
- (B) Check whether the binary operation * is commutative and associative. * is defined as (7)
 $a * b = ab/2$ for $a, b \in \mathbb{Q}$.
- (C) Show that R defined on $\mathbb{Z} \times \mathbb{Z}$ defined by $(x_1, x_2) R (y_1, y_2)$ iff $x_1 + y_2 = y_1 + x_2$ is an (7)
equivalence relation.

Q.4 Attempt The Following questions: (15 Marks)

- (A) Explain the functions giving one example each. (8)
(i) Invertible Function (ii) Bijective Function
- (B) If $f, g : \mathbb{R} \rightarrow \mathbb{R}$ is defined as $f(x) = 2x^2 + 1$ and $g(x) = x + 2$, then find (7)
(i) $(f \circ g)(x)$ (ii) $(g \circ f)(x)$ (iii) if $(f \circ g)(x) = (g \circ f)(x)$.
- (C) Show that if any five numbers from 1 to 8 are chosen then two of them will add up to (7)
9.

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Q.5 Attempt The Following questions: (15 Marks)

- (A) Write a note on Prim's algorithm to find minimal spanning tree in a graph. (8)
- (B) Use seven vertices to draw a graph and its complement. (7)
- (C) Give example of Hamiltonian graph which is not Eulerian. (7)

Q.6 Attempt The Following questions: (15 Marks)

- (A) Show that $\mathbb{Z}[i]$ is an integral domain but not a field. (8)
- (B) Is $(Q, *)$ a monoid? Q is set of rational numbers and $*$ is defined on Q as $a * b = a + b - ab$. (7)
- (C) Define a subgroup of a group. Is every subgroup of abelian group, a normal subgroup? Justify. (7)

Q.7 Attempt The Following questions: (15 Marks)

- (A) Solve the relation $a_n = a_{n-1} + a_{n-2}; n \geq 2$ with $a_1 = a_2 = 1$. (8)
- (B) Determine the coefficient of x^6 in generating function $(1 + 2x)^{-7}$. (7)
- (C) Find generating function for $f_k = 5 + 2k$. (7)