বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examination 2023

(Under CBCS Pattern)

Semester — II

Subject : COMPUTER SCIENCE

Paper : C–4T

(Discrete Structures)

Full Marks : 60

Time : 3 hours

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer from **all** the Groups as directed.

GROUP—A

1. Answer *any* **ten** questions from the following : $2\times10=20$

(a) If $A=\{3, 5, 6, 8\}$, $B=\{-3, 0, 6\}$, find $(A\cup B)-(A\cap B)$

(b) Let the function $f: R \to R$ be defined by $f(x) = 2x + 3$, $x \in R$ (R is a set of all real numbers). If $A = \{x : 1 \le x \le 2\}$, find $f(A)$.

(c) Let $f: R \to R$ and $g: R \to R$ be defined by $f(x) = x + 9$ and $g(x) = x^2 + 3$, find $(f \circ g)(-3)$.

(d) Draw a simple graph having degree sequence (3, 3, 3, 3, 4).

(e) Find the number of vertices of a 4-regular graph with ten edges.

(f) Give an example of a connected graph which has a Hamiltonian path but no Hamiltonian cycle.

(g) Find the coefficient of x^5 in $(1-2x)^{-7}$.

(h) Find the unique solution of the recurrence relation $a_{n+1} - 1{\cdot}5\, a_n = 0$, $n \ge 0$.

(i) What do you mean by weighted graph?

(j) Give an example of isomorphism graph.

(k) Define reflexivity and symmetric of a relation.

(l) Define pigeonhole principle.

(m) Prove $(A \cup B)^c = A^c \cap B^c$

(n) Define multigraph with example.

(o) Why are asymptotic notations used?

GROUP—B

Answer *any* **four** questions from the following : 5×4=20

2. Use the principle of mathematical induction to prove that $10^{n+1} + 10^n + 1$ is divisible by 3, where n is a natural number.

3. Find the number of integers between 1 and 10000 inclusive, which are divisible by none of 5, 6 or 8.

4. Let $A = \{1, 2, 3, 6, 9, 18\}$ and define R on A by xRy if $x \mid y$. Draw the Hasse diagram for the poset (A, R).

5. Determine the sequence generated by $(1-4x)^{-\frac{1}{2}}$.

6. If $G = (V, E)$ is an undirected graph then prove that G is connected if and only if G has a spanning tree.

7. For $A, B, C \in U$, prove that
$$A \times (B - C) = (A \times B) - (A \times C).$$

GROUP—C

Answer *any* **two** questions from the following : 10×2=20

8. (a) Solve the recurrence relation
$$a_{n+1} - a_n = 3n^2 - n,\ n \ge 0,\ a_0 = 3$$

(b) Let $G = (V, E)$ be a simple graph order n having k components. Then show that the size of G can be at most $\frac{1}{2}(n-k)(n-k+1)$.

5+5=10

9. (a) For primitive statements p, q, r and s, simplify the compound statement
$[[[(p \wedge q) \wedge r] \vee [(p \wedge q) \wedge \rightarrow r]] \vee \rightarrow q] \rightarrow S$

(b) If the degree of every vertex of a connected graph is even, then prove that it is an Eulerian graph. Justify the converse of the theorem. 5+5=10

10. (a) Prove the following by mathematical induction : 5

$$1^2 + 2^2 + 3^2 + \ldots\ldots + (-1)^{n+1} n^2 = \frac{(-1)^{n+1} n(n+1)}{2}$$

(b) Draw the unique binary tree when the following is given : 5

Inorder	d	b	h	e	a	f	c	i	j	g
Preorder	a	b	d	e	h	c	f	g	i	j

11. (a) How many 4-digit numbers can be formed by using the digits 2, 4, 1, 6, when repetition of digits is allowed? 5

(b) Prove that $p \vee (q \wedge r) \leftrightarrow [(p \vee q) \wedge (p \vee r)]$ is a tautology. 5

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