



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 :
2×10=20

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

(2)

- (b) Let the function $f: R \rightarrow R$ be defined by $f(x) = 2x + 3$, $x \in R$ (R is a set of all real numbers). If $A = \{x: 1 \leq x \leq 2\}$, find $f(A)$.
- (c) Let $f: R \rightarrow R$ and $g: R \rightarrow R$ 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 $a_{n+1} - 1.5 a_n = 0$, $n \geq 0$.
- (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?

(Continued)

(3)
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 $x|y$. 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

$$A \times (B - C) = (A \times B) - (A \times C).$$

Handwritten notes for Q7:
 $x \in A \times (B - C)$
 $\Rightarrow x \in A \text{ and } y \in B - C$
 $\Rightarrow x \in A \text{ and } (y \in B \text{ and } y \notin C)$
 $\Rightarrow (x \in A \text{ and } y \in B) \text{ and } (x \in A \text{ and } y \notin C)$
 $\Rightarrow x \in (A \times B) \text{ and } x \notin (A \times C)$
 $\Rightarrow x \in (A \times B) - (A \times C)$

GROUP—C

Answer any **two** questions from the following :

10×2=20

8. (a) ✓ Solve the recurrence relation

$$a_{n+1} - a_n = 3n^2 - n, n \geq 0, a_0 = 3$$

Handwritten solution for Q8:
 1696 $x \in (A \times B) - (A \times C)$
 $\Rightarrow x \in A \text{ and } y \in B \text{ and } z \in C$
 $\Rightarrow x \in A \text{ and } (y \in B \text{ and } z \notin C)$
 $\Rightarrow x \in A \text{ and } (y \in B \text{ and } z \notin C)$
 $\Rightarrow x \in (A \times B) - (A \times C)$

(Turn Over)

$2 \frac{60}{14}$

(4)

(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

$$[[[(p \wedge q) \wedge r] \vee [(p \wedge q) \wedge \neg r]] \vee \neg q] \rightarrow S$$

(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 :

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

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

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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?

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

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