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Odd Semester Examination-2024

Paper Title: Discrete Structures
Time: 2.5 hours

Paper Code: BCA-303/BSC-303
Maximum Marks: 60

SECTION-A

Attempt ALL questions

(20×1=20)

Verify the Statements (True/False)

S.No	Questions	CO	BL
1	Logical equivalence means two formulas have the same truth value in all interpretations.	CO1	BL2
2	$P \wedge (Q \wedge R)$ is equivalent to $(P \wedge Q) \wedge R$	CO1	BL2
3	The union of two sets contains all elements present in both sets.	CO2	BL3
4	The complement of a set A within a universal set U is A-U.	CO2	BL2
5	A relation is a subset of the Cartesian product of two sets.	CO3	BL3
6	An equivalence relation must be reflexive, symmetric, and transitive.	CO3	BL2
7	The inverse of a function exists only if the function is one-to-one and onto.	CO4	BL3
8	The domain of a function is the set of its outputs.	CO4	BL3
9	A recurrence relation expresses each term of a sequence as a function of its previous terms.	CO5	BL2
10	The Fibonacci sequence is not an example of a recurrence relation.	CO5	BL2
11	A contradiction is a statement that is sometimes false.	CO1	BL2
12	The proposition $(p \wedge q) \wedge \sim (p \vee q)$ is a contradiction.	CO1	BL3
13	If $X = \{1, 2, 3, 4\}$ and $F = \{(1, 5), (2, 9), (3, 1), (4, 5), (2, 11)\}$. Then F is a function.	CO2	BL3
14	If A and B are equal sets, then $A \times C = B \times C$ for any set C.	CO2	BL4
15	A reflexive relation requires every element to be related to itself.	CO3	BL2
16	A relation on a set is always a function.	CO3	BL1
17	A constant function assigns the same value to all inputs.	CO4	BL2
18	A one-to-one function maps every input to a unique output.	CO4	BL2
19	A recurrence relation can only involve the immediately preceding term.	CO5	BL3
20	A recurrence relation must always have initial conditions.	CO5	BL2

SECTION-B

Attempt any **FOUR** questions

(4×5=20)

S.No	Questions	CO	BL
1	Show that the propositions $\neg(p \wedge q)$ and $\neg p \vee \neg q$ are logically equivalent.	CO1	BL5
2	Explain the difference between relations and functions, and whether every relation is a function.	CO3	BL3
3	Let $R = \{(a, b) : a, b \in \mathbb{Z} \text{ and } b = 2a - 4\}$. If $(a, -2) \in R$ and $(4, b) \in R$, find the values of a and b .	CO3	BL5
4	If $f(x) = x^2 - 3x + 4$ and $f(x) = f(2x + 1)$, find the values of x .	CO4	BL5
5	Solve the recurrence relation: $a_n = 3a_{n-1}$ with $a_0 = 4$	CO5	BL4
6	Solve the recurrence relation $T(n) = T(n - 1) + 2$ with initial condition $T(1) = 3$.	CO5	BL5

SECTION-C

Attempt any **TWO** questions

(2×10=20)

S.No	Questions	CO	BL
1	Find the solution of the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2} - 2$ With initial condition $a_0 = 1$ and $a_1 = 6$	CO5	BL4
2	If $f(x) = 3x + 4$ and $g(x) = x^2 + 4$, then find $(f \circ g)(x)$ and $(g \circ f)(x)$.	CO4	BL4
3	If $A = \{a, b, c, d, e\}$, $B = \{a, c, e, g\}$, and $C = \{b, e, f, g\}$, prove that $A - (B \cap C) = (A - B) \cup (A - C)$.	CO2	BL5
4	Solve the recurrence relation $T(n) = T(n/2) + C$ if $n > 1$ and $T(n) = 1$ if $n = 1$.	CO5	BL5

BL - Bloom's Taxonomy Levels: (1-Remembering, 2-Understanding, 3-Applying, 4-Analyzing, 5-Evaluating, 6-Creating).