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Examination: Odd Semester Examination 2022

Paper Name: Discrete Structure
Time: 3 Hours

SECTION A

Paper Code: BCA-303
Maximum Marks: 75

All Thirty Five questions are compulsory

Fill up the blanks or answer as True or False. **Marking Scheme: 35x1=35**

Q.N.	Questions	CO	BL
1	A proposition is a declarative statement which is always true. **True/ False.**	CO1	L1
2	The expression 2x+ 6=10 is a proposition. **True/ False**	CO1	L2
3	The dual of $(\overline{x}+0)\cdot(\overline{y}\cdot z)$ is	CO1	L2
4	Negation is a logical operation that takes only one argument. **True/ False**	CO1	L1
5	$p \oplus q$ is true when p is true and q is false, and when p is false and q is true. **True/ False**	CO1	L1
6	$p \leftrightarrow q$, means q unless $\neg p$. **True/ False**	CO1	L3
7	Contrapositive of $p \rightarrow q$, is	CO2	L2
8	A proposition which is always false is called	CO1	L1
9	$\neg(p \wedge \neg p)$ is a tautology. **True/ False**	CO1	L3
10	Number of different possible boolean functions of degree n is	CO2	L4
11	The set $\{\{\}\}$ represents a null set. **True/False**	CO4	L4
12	The set A={1, 3, 3, 3, 5, 5, 5, 5, 5}, and B={5, 3, 1} are equal sets. **True/False**	CO4	L4
13	If $P = \{x : x = 2n,\ n \in N\}$ and $Q = \{x : x\ 2n + 1,\ n \in N\}$ then P and Q are disjoint sets. **True/False**	CO4	L4
14	Let set $S = \{\emptyset, \{\emptyset\}\}$. The power set of S is	CO4	L4
15	$A \oplus B = A \cup B - A \cap B$. **True/False**	CO4	L5
16	$A - B$, is the set containing those elements that are either in set A or in set B. **True/False**	CO4	L3
17	Is the $\leq$ relation on the set of positive integers reflexive?	CO4	L4
18	A relation is **asymmetric** if and only if it is both **anti-symmetric** and **irreflexive**. **True/False**	CO4	L1
19	Let A={1,2,3,4}. The relation $R = \{(2,\ 1),(3,\ 1),(3,\ 2),(4,\ 1),(4,\ 2),(4,\ 3)\}$ is transitive. **True/False.**	CO4	L4
20	A relation is reflexive iff there is a self loop at every vertex of the its directed graph representation.**True/False.**	CO4	L2
21	A relation is ...... iff for every edge between distinct vertices in its digraph there is an edge in the opposite direction.	CO4	L2
22	If the order pairs (x + 2,4) and (5, 2x + y) are equal then the value of x is ...... and the value of y is	CO4	L5
23	If $f(x) = cos(x)$ and $g(x) = 3x^2 + 2x$, then the value of $g \circ f(x)$ is	CO4	L3
24	A function which is injective as well as surjective is also called Bijective function. **True/False**	CO4	L1
25	Bijective functions are not Invertible. **True/False**	CO4	L2
26	Let f be the function that assigns the last three bits of a bit string of length 3 or greater to that string. The range of the function is	CO4	L6
27	The identity function is a bijection. **True/False**	CO5	L2
28	The recurrence relation $a_n = a_{n-1}^2 + a_{n-2} + n^3$ is a homogeneous recurrence relation with constant coefficient. **True/False**	CO5	L2
29	The value of a_3 for the recurrence relation $a_n = 2a_{n-1} + 3$. with $a_0 = 2$ is	CO5	L4
30	Characteristic roots of the characteristic equation for the recurrence relation $a_n = 5a_{n-1} - 6a_{n-2}$ are	CO5	L3
31	The characteristic equation of the associated homogeneous recurrence relation for $a_n = a_{n-1} + 2a_{n-2} + n^2$. is	CO5	L3

Q.No.	Questions	CO	BL
32	The solution for the recurrence relation $a_n = 2 * a_{n-1};\ n > 1$ with initial condition $a_1 = 1$ is	CO5	L5
33	The union of the equivalence classes of relation R on set A form set A. **True/False**	CO3	L2
34	Range and Codomain of an Onto function are same. **True/False**	CO3	L3
35	The *minterm* that equals 1 corresponding to inputs $x_2 = x_5 = 0$ and $x_1 = x_3 = x_4 = 1$, and 0 otherwise is	CO3	L6

SECTION B

Attempt any **FOUR** questions out of **SIX** **Marking scheme:** 4x5=20

Q.No.	Questions	Marks	CO	BL
1	Construct truth table for the compound propositions: i) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$ ii) $\neg p \rightarrow (\neg q \vee r)$	5	CO2	L6
2	Show that $(p \rightarrow r) \vee (q \rightarrow r)$ and $(p \wedge q) \rightarrow r$ are logically equivalent.	5	CO2	L4
3	Let $f : R - \{1\} \rightarrow R - \{3\}$ defined by $f(x) = \frac{2x+3}{x-3}$. a) Show that f is bijective function b) Find $f^{-1}(x)$	5	CO4	L5
4	Let A, B, and C are sets, then show that: a) $\overline{A \cup (B \cap C)} = (\overline{C} \cup \overline{B}) \cap \overline{A}$. b) $\overline{A \cup B} = \overline{A} \cap \overline{B}$	5	CO4	L2
5	Show that the relation $R = \{(a, b) \mid a \equiv b(mod\ m)\}$ with m be an integer $m > 1$ is equivalence relation on the set of integers. Also find the sets in the partition of the integers arising from congruence modulo 3?	5	CO4	L2
6	Find the explicit formulae for the recurrence relation $a_n = a_{n-1} + a_{n-2}$ with initial conditions $a_0 = 0$ and $a_1 = 1$	5	CO5	L5

SECTION C

Attempt any **TWO** questions out of **FOUR** **Marking Scheme:** 2x10=20

Q.No.	Questions	Marks	CO	BL
1	Show that the following expressions is/are tautology or contradictions: a) $[(p \wedge r) \vee (q \wedge \neg r)] \leftrightarrow [(\neg p \wedge r) \vee (\neg q \wedge \neg r)]$ b) $[(p \vee q) \wedge (\neg p \vee r)] \rightarrow (q \vee r)$	10	CO2	L4
2	Solve the following: a) For sets A, B, and C, prove: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ b) Define **composition** of functions. Let f and g be the functions from the set of integers to the set of integers defined by f (x) = 2x + 3 and g(x) = 3x + 2. Show that $f \circ g \neq g \circ f$.	10	CO4	L4,L3
3	Solve the following: a) Find the standard SOP form of the following: i) $F(x, y, z) = x + y\overline{z} + \overline{x}yz$ ii) $F(x, y, z) = (x + y)\overline{z}$ b) Define **partition** of a set. Let A = {1, 2, 3, 4}. For partition {{1, 3}, {2, 4}} of A, determine the elements of the corresponding equivalence relation R?	10	CO3,CO4	L5,L2
4	Solve the recurrence relation together with initial conditions given: a) $a_n = 5a_{n-1} - 6a_{n-2}$ for $n \geq 2$, $a_0 = 1$, $a_1 = 0$ b) $a_n = 4a_{n-1} - 4a_{n-2}$ for $n \geq 2$, $a_0 = 6$, $a_1 = 8$	10	CO5	L5

Bloom's Taxonomy Levels: (1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating) CO: Course Outcome

*** END***

$2^3 \to 8$

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