

S.No: 6708

P8MCA10

(For candidates admitted from 2008-2015 Batch)  
M.C.A. DEGREE EXAMINATION, APRIL 2021  
Computer Applications  
DISCRETE MATHEMATICS

Time: 3 hrs

Maximum Marks: 75

**PART A – (10 x 2 = 20)**

**Answer ALL the questions**

1. Given  $A = \{1,2,3,4\}$  and  $B = \{2,3,4,5\}$  prove that  $A - B \neq B - A$ .
2. Let  $R$  be a relation given by  $R = \{<1,2>, <2,1>, <2,2>\}$  state whether  $R$  is a compatible relation?
3. Prove that  $(P \wedge (P \rightarrow Q)) \rightarrow Q$  is a tautology.
4. Symbolize the statements "Every apple is red".
5. Define "Abelian group".
6. What is a left coset?
7. Given a Boolean algebra  $\langle B, *, \oplus, ', 0, 1 \rangle$  prove the identity  $a \oplus (a' * b) = a * b$ .
8. Given a Boolean algebra  $\langle B, *, \oplus, ', 0, 1 \rangle$  prove the identity  $(a * b * c) \oplus (a * b) = (a * b)$ .
9. State True or False. IF  $a_1 = 5$  and  $a_{k+1} = 3a_k$  for  $k \geq 1$  then  $a_3 = 45$  and  $a_7 = 16665$ .
10. In how many ways you can get a total of 6 when rolling 2 dice?

**PART B – ( 5 X 5 = 25)**

**Answer ALL the questions**

- 11 a). Given a set  $A$ , prove that  $A + \emptyset = A$  where  $+$  is the symmetric difference (or Boolean sum).  
**OR**
- 11 b). Given functions  $f : X \rightarrow Y$ ,  $g : Y \rightarrow Z$  and  $h : Z \rightarrow W$ , prove that composition of functions is associative.
- 12 a). Construct truth table for  $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$ .  
**OR**
- 12 b). Prove using truth table  $\neg(P \downarrow Q) \Leftrightarrow \neg P \uparrow \neg Q$  where  $P \uparrow Q \Leftrightarrow \neg(P \wedge Q)$  and  $P \downarrow Q \Leftrightarrow \neg(P \vee Q)$ .
- 13 a). If  $\langle G, * \rangle$  is an abelian group, then for all  $a, b \in G$ , show that  $(a * b)^n = a^n * b^n$ .  
**OR**
- 13 b). Write short notes on Hamming codes.
- 14 a). Show that the following Boolean expressions are equivalent
  - a.  $(x \oplus y) * (x' \oplus z) * (y \oplus z)$
  - b.  $(x * z) \oplus (x' * y) \oplus (y * z)$
  - c.  $(x \oplus y) * (x' \oplus z)$
  - d.  $(x * z) \oplus (x' * y)$**OR**
- 14 b). Simplify the Boolean expression
  - a.  $(a * b)' \oplus (a \oplus b)'$
  - b.  $(a' * b' * c) \oplus (a * b' * c) \oplus (a * b' * c')$

15 a). Find the first seven terms of the sequence  $\{a_n\}$  defined for  $k \geq 1$

$$a_{k+1} = \begin{cases} 1 & \text{if } a_k = 1 \\ \frac{1}{2}a_k & \text{if } a_k \text{ is even} \\ \frac{1}{2}(a_k - 1) & \text{if } a_k \neq 1 \text{ is odd} \end{cases}$$

- a. with  $a_1 = 16$
- b. with  $a_1 = 17$
- c. with  $a_1 = 21$
- d. with  $a_1 = 50$

**OR**

15 b). Find a formula for the  $n^{\text{th}}$  term of the Fibonacci sequence.

**PART C – ( 3 X 10 = 30)**

**Answer ANY THREE questions**

- 16). What are the properties of relation? Given  $X = \{\text{ball, bed, dog, let, egg}\}$  and the relation  $R$  is given by  $R = \{ \langle x, y \rangle \mid x, y \in X \wedge x R y \text{ if } x \text{ and } y \text{ contain some common letter} \}$ , prove that  $R$  is a compatible relation.
- 17). Prove the implication  $(P \rightarrow Q) \wedge (R \rightarrow S) \wedge (\neg Q \vee \neg S) \Rightarrow (\neg P \vee \neg R)$ .
- 18). Write short notes on
  - a. Error correcting codes
  - b. Modular arithmetic grammars
- 19). State the identities satisfied by a Boolean algebra  $\langle B, *, \oplus, ', 0, 1 \rangle$  as a bounded complemented distributive lattice.
- 20). An urn contains 15 red balls and ten white balls. A sample of five balls is selected.
  - a. How many different samples are possible?
  - b. How many samples contain all red balls?
  - c. How many samples contain three red balls and two white balls?

-----