

**BCA-02**

December - Examination 2015

**BCA Ist Year Examination****Discrete Mathematics****Paper - BCA-02****Time : 3 Hours ]****[ Max. Marks :- 100**

**Note:** The question paper is divided into three sections A, B and C.  
Write answers as per given instructions.

**Section - A**

10 x 2 = 20

(Very Short Answer Questions)

**Note:** Answer **all** questions. As per the nature of the question delimit your answer in one word, one sentence or maximum upto 30 words. Each question carries 2 marks.

- 1) (i) Explain cardinality of a set.
- (ii) What is tautology?
- (iii) Explain inverse of a relation, with suitable example.
- (iv) 'Every lattice is a poset but converse need not necessarily be true'. Justify the statement.
- (v) Specify the condition, when a group  $G$  is said to be simple group.
- (vi) Tell in brief about Cancellation laws in a ring.
- (vii) If  $a^2 + b = 1$  then, what is value of  $ab^2$ ?
- (viii) Write the dual of the expression  $ab + ac$ '.

- (ix) Justify the statement that ‘Number of switches involved in the bridge-circuit is always less than that of number of switches involved in equivalent (corresponding) series-parallel switching circuit.’
- (x) Which logic gate is also called inverter, and why?

### Section - B

4 x 10 = 40

#### (Short Answer Questions)

**Note:** Answer any **four** questions. Each answer should not exceed 200 words. Each question carries 10 marks.

- 2) Explain the method of subtraction of binary numbers using complement method. Illustrate by subtracting 1010 from 11001 using complement method.
- 3) Explain with example, Roster and Set builder form to represent a set.
- 4) What do you mean by Partition of a set, explain with suitable example? Also, examine whether the following is partition of the set  $N$  of natural numbers  

$$P = [ \{n \mid n > 3\}, \{1, 2, 3, 4\} ]$$
- 5) Write the following compound propositions in symbolic form:
  - (i) It is not hot
  - (ii) It is hot or it is not raining
  - (iii) He is dark but tall
  - (iv) It is false that it is raining or it is cold
  - (v) Laxman is neither tall nor intelligent
- 6) Draw Hasse diagram of poset  $(A, |)$   
 where  $A = \{1, 2, 3, 4\}$  ;  $a R b$  if  $a \mid b$ .
- 7) Let  $S = N \times N$ . If  $*$  is a binary operation on  $S$  defined by  
 $(a_1, b_1) * (a_2, b_2) = (a_1 + a_2, b_1 + b_2)$  for  $(a_1, b_1), (a_2, b_2) \in S$ 
  - (i) Show that  $(S, *)$  is a semigroup.
  - (ii)  $(S, *)$  is not a monoid

- 8) In the Boolean algebra B, prove that for elements a, b, c  $\in$  B
- (i)  $(a + b)(a' + c)(b + c) = ac + a'b + bc$
  - (ii)  $(a + b)' + (a + b')' = a'$
  - (iii)  $ab + a'b' = (a + b')(a' + b)$
  - (iv)  $a + bc = (a + b)(a + c)$
- 9) 'NOR gate and NAND gate are universal gates.' Justify the statement, with suitable example(s).

### Section - C

2 x 20 = 40

(Long Answer Questions)

**Note:** Answer any **two** questions. You have to delimit your each answer maximum upto 500 words. Each question carries 20 marks.

10) Perform following conversions:

- |                                  |                                 |
|----------------------------------|---------------------------------|
| (i) $(39.625)_{10} = (?)_2$      | (ii) $(100.101)_2 = (?)_{10}$   |
| (iii) $(101101.01)_8 = (?)_{10}$ | (iv) $(347.12)_{16} = (?)_{10}$ |
| (v) $(567)_{10} = (?)_8$         | (vi) $(110010)_2 = (?)_8$       |
| (vii) $(43215)_8 = (?)_2$        | (viii) $(111011)_{16} = (?)_2$  |
| (ix) $(111011)_2 = (?)_{16}$     | (x) $(23487)_{10} = (?)_{16}$   |

11) Describe following terms, with suitable example:

- |                        |                       |
|------------------------|-----------------------|
| (i) Equivalent Sets    | (ii) Equal Sets       |
| (iii) Singleton Set    | (iv) Sub Sets         |
| (v) Proper Subsets     | (vi) Improper Subsets |
| (vii) Power Set        | (viii) Universal Set  |
| (ix) Complement of Set | (x) Disjoint Sets     |

12) Solve the following:

(i) Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  and  $g: \mathbb{R} \rightarrow \mathbb{R}$  be two functions such that

$$f(x) = x-1, g(x) = x/2$$

Then find  $f \circ g$  and  $g \circ f$

(ii) Find the inverse of function  $f: \mathbb{R} \rightarrow \mathbb{R}$  defined as

$$f(x) = 3x + 8$$

(iii) Let  $A = \mathbb{R} - \{3\}$ ,  $B = \mathbb{R} - \{1\}$ , show that function  $f: A \rightarrow B$ , such that

$$f(x) = (x-4)/(x-3) \text{ is one-one onto.}$$

(iv) Let  $A = \{-2, 1, 3, 4\}$ . A function  $f: A \rightarrow A$  is defined such that

$$f(x) = x^2 - 2x + 2$$

Find range of  $f(x)$  and pre-image of 5.

13) Perform tasks as specified in following questions:

(i) Construct the logic circuit using only NAND gates for Boolean expression

$$E(x, y, z) = (x' + y)z + y' + xz$$

(ii) Implement the Boolean expression for XNOR gate, using only NOR gates.

(iii) Draw the logic circuit for Boolean expression

$$E(x, y, z) = (x + yz)' + y$$

(iv) Show that the Boolean expression  $E(x, y, z) = x y z'$ , can be implemented with one two input NOR gate and one two input NAND gate.