

Goa Vidyaprasarak Mandal's  
Gopal Govind Poy Raiturcar College of Commerce and Economics  
Ponda-Goa

B.C.A. (Semester - II) Examination, April 2017  
204 DISCRETE MATHEMATICS

Duration : 2 Hrs

Marks : 50

Instructions:

*I. All the questions are compulsory however internal choices are given.*

*II. Use of calculators is not allowed.*

*III. Marks to the right indicate full marks.*

**Q.1.** Fill in the following blanks: (10)

- i. Base for the binary number system is .....
- ii. Negation of "p:n is a prime number" is .....
- iii. Idempotent law on a Boolean algebra is given by .....
- iv. Let  $X = \{n \mid n \text{ is a natural number}\}$ ,  $A = \{2n+1 \mid n \text{ is a natural number}\}$ . Then complement of A ( $A^c$ ) = .....
- v.  $(84)_{10}$  is equivalent to ..... in binary form.
- vi. If  $f(x) = 2x$  and  $g(x) = \log x$  then  $f \cdot g(x) = \dots\dots\dots$
- vii. The number of ways in which a 3 digit number can be formed out of 5 digits (when repetition is not allowed) is .....
- viii. If  $f$  and  $g$  are bijective functions such that  $f$  is inverse of  $g$  then  $(f \cdot g)(x) = \dots\dots\dots$
- ix. Length of the string 'xyxyxyx' is .....
- x.  ${}^5P_3 = \dots\dots\dots$

**Q.2.**

- i. Convert  $(101101)_2$  to its equivalent octal number form. (2)
- ii. Find the coefficient of  $x^5y^3$  in the expansion of  $(x-2y)^8$ . (3)
- iii. Let  $A = \{1,3,5,7,9\}$  and  $R = \{(a,b) \mid a \leq b\}$ .  
What are the elements in R? Is R a partially ordered set? Justify (5)

**OR**

- i. Convert  $(0.3125)_{10}$  to binary form. (2)
- ii. Using binomial theorem show that  $\sum_{k=0}^n \binom{n}{k} = 2^n$ . ( $\binom{n}{k} = {}^nC_k$ ) (3)
- iii. Let  $A = \{2,4,6,8,10,12,14\}$  and relation R on A be given by  $R = \{(a,b) \mid a \text{ divides } b\}$ . What are the elements of R? Is R an equivalence relation? Justify. (5)

## Q.3.

- i. Check whether the following statements are equivalent (3)  
 $p \rightarrow q$  and  $(\sim p \vee q)$
- ii. Write  $p \vee (q \rightarrow r)$  for the following statements (2)  
 $p$  :  $n$  is an odd number,  
 $q$ :  $n$  is a composite number,  
 $r$ :  $n$  is not divisible by 5.
- iii. Show that  $(a + b) \cdot (\bar{b} + c) + b \cdot (\bar{a} + \bar{c}) = a \cdot \bar{b} + a \cdot c + b$ . (5)

OR

- i. Show that  $(p \uparrow q) \oplus (p \uparrow q)$  is a contradiction. (2)
- ii. If  $x = -4$  then  $x^2 - 7x + 12 = 0$ .  
 Write converse and inverse of the above implication. (3)
- iii. Simplify the Boolean expression  $(x + y) \cdot (x + z) \cdot \overline{(x \cdot y)}$ . (5)

## Q.4.

- i. Using principle of mathematical induction show that the sum of first  $n$  natural numbers is  $\frac{n(n+1)}{2}$ . (3)
- ii. Let  $f: \mathbf{R} \rightarrow \mathbf{R}, f(x) = 3x + 1$ . Is  $f$  injective? Justify. (2)
- iii. Of the total number of 200 students appearing in an examination, 140 passed in mathematics and 100 passed in statistics. If 50 of them failed in both mathematics and statistics, find the number of students who have passed in both. (5)

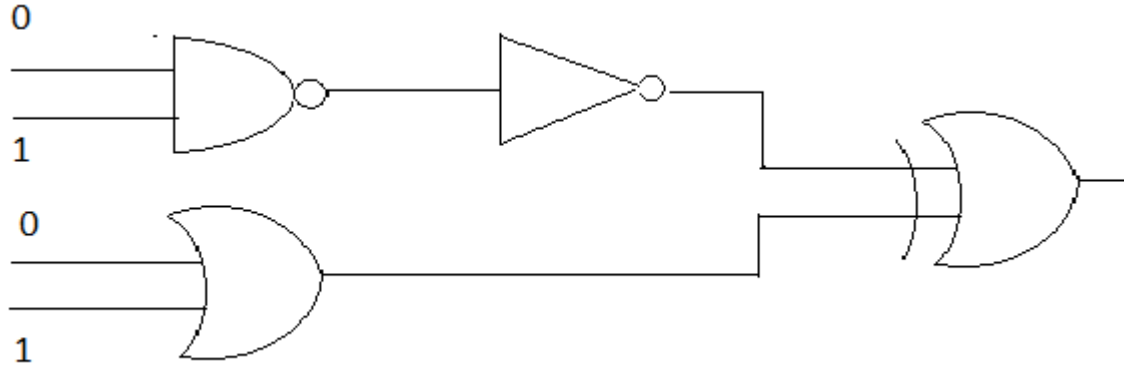
OR

- i. Show that  $1^3 + 2^3 + \dots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$ . (3)
- ii. Let  $f: \mathbf{R} \rightarrow \mathbf{R}, f(x) = x^4$ . Is  $f$  surjective? Justify. (2)
- iii. In a group of 150 people of a certain locality, the number of people reading newspapers 'Navhind Times', Herald and Gomantak Times are 50, 40, 47 respectively. 15 read both Navhind Times and Herald, 14 read Herald and Gomantak Times, 13 read Gomantak Times and Navhind Times. 5 read all the three newspapers. Find the number of people who read neither of the newspapers. (5)

## Q.5.

- i. Let  $X = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ ,  $A = \{1, 3, 5, 7, 8, 9\}$  and  $B = \{1, 2, 3, 4, 5, 6\}$ ,  
 Verify  $(A \cap B)^c = A^c \cup B^c$ . (2)

- ii. Give the output for the following (2)

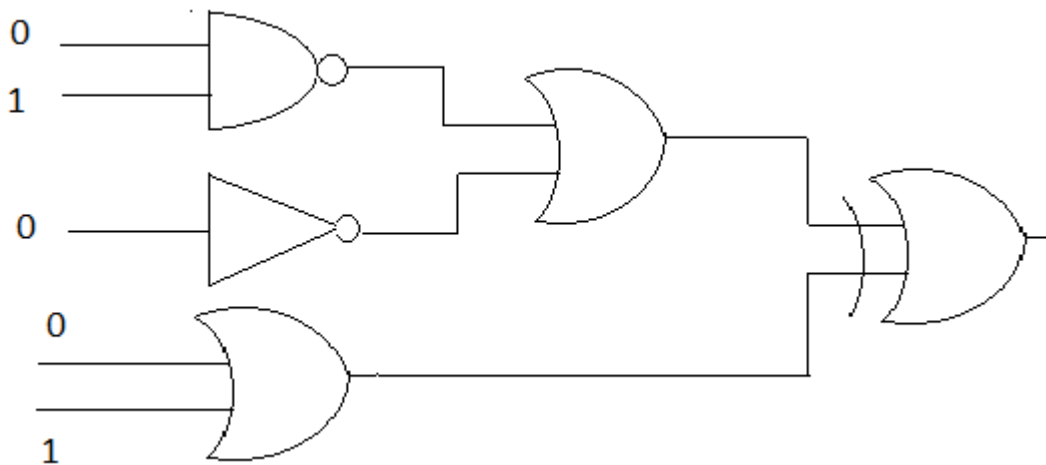


- iii. How many numbers can be formed with the digits 1,2,3,4,3,2,1 so that odd digits always occupy the odd places. (2)
- iv. Let  $G = \{N, V, \sigma, P\}$ , where  $N = \{S, Q, R, T\}$  (with S as the starting point),  $V = \sigma = \{a, b, c, d\}$  and  $P = \{S \rightarrow aQ, Q \rightarrow aQ, Q \rightarrow cR, R \rightarrow bT, R \rightarrow cT, T \rightarrow d\}$ . What is the language generated by G? (4)

OR

Q.V.

- i. Let  $X = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ ,  $A = \{3, 4, 7, 9, 10\}$  and  $B = \{1, 2, 4, 5, 7, 8, 9\}$ . Verify  $(A \cup B)^c = A^c \cap B^c$ . (2)
- ii. How many different words can be formed with the letters of the word 'INDIA' so that I and N are never together? (2)
- iii. Find output for the following (2)



- iv. Define finite state machine and write down its major features. (4)

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