

MCA (Revised) / BCA (Revised)

Term-End Examination

December, 2016

13285

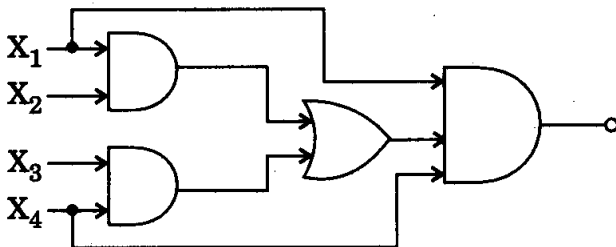
MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours

Maximum Marks : 50

Note : Question number 1 is compulsory. Attempt any three questions from the rest.

1. (a) Using the truth table, show that : 4
- (i) $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$
- (ii) $\sim (p \rightarrow q) \equiv p \wedge \sim q$
- (b) Prove that $\sqrt{2}$ is irrational. 3
- (c) Find the Boolean expression for the output of the following circuit : 3



- (d) Make Venn diagram for the following set of expressions : 2
- (i) \bar{A}
- (ii) $A \Delta B$ (Symmetric difference)
- (iii) $A \cap B \cap C$
- (iv) $A \cup B - C$
- (e) Let there be a relation f defined as $f = \{(a, 1), (a, 2), (d, 3), (c, 4)\}$. Is f a function? If not, why? 2
- (f) How many distinct three-letter words can be formed from the letters of the word MAST? 2
- (g) In how many ways can a student choose 8 questions out of 10 in an exam? 2
- (h) A coin is tossed n times. What is the probability of getting exactly r heads? 2
2. (a) Prove the following : 3
- $$\sim (\exists x P(x)) \equiv \forall x (\sim P(x))$$
- (b) Use mathematical induction to prove that 3
- $$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$
- (c) Write the contrapositive and converse of the following sentence : 2
- “If $2 + 2 = 5$, then I am Prime Minister of India.”
- (d) Explain proof by contradiction, with the help of an example. 2

3. (a) Reduce the following equations to simpler form : 4

(i)
$$F(a, b, c) = (a' \wedge b' \wedge c') \vee (a' \wedge b' \wedge c) \vee (a \wedge b \wedge c')$$

(ii)
$$F(a, b) = (a' \wedge b') \vee (a' \wedge b) \vee (a \wedge b')$$

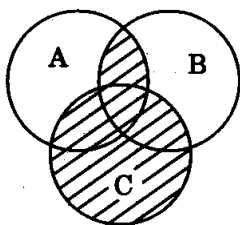
(b) Construct logic circuits for the following Boolean expressions : 4

(i)
$$(a \wedge b \wedge c) \vee (b \wedge c)' \vee (a \wedge b)'$$

(ii)
$$(a' \wedge b') \vee (b' \wedge c) \vee d$$

(c) What is dual of a Boolean expression ? Explain the principle of duality with the help of an example. 2

4. (a) Describe the following region using intersection and union : 2



(b) Let $A = \{1, 2, 3, 4\}$ be a set and a relation R is defined on A such that aRb if $a \geq b$. Check if R is (i) reflexive, (ii) symmetric, (iii) transitive, and (iv) asymmetric. 4

- (c) Let there be a function $f : A \rightarrow B$, where A and B are sets defined as follows :
- $A = \{ a, b, c, d \}$, $B = \{ p, q, r, s \}$
 $f = \{ (a, p), (b, q), (c, r), (d, p) \}$
- Explain if f is
- (i) one to one,
 - (ii) onto,
 - (iii) bijective. 2
- (d) Prove that $A - (A - B) = A \cap B$ using Venn Diagram. 2
5. (a) Make Pascal's triangle up to $n = 6$. 3
- (b) Let A and B be two mutually exclusive events such that $p(A) = 0.6$ and $p(B) = 0.3$.
 What is the probability that
- (i) A does not occur ?
 - (ii) A and B both occur simultaneously ? 2
- (c) How many ways are there to distribute r distinct objects into 5 distinct boxes with no empty box ? 3
- (d) Disprove the following statement : 2
- $(\forall a \in \mathbf{R}) (\forall b \in \mathbf{R}) [(a^2 = b^2) \Rightarrow (a = b)]$
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