

MCA (Revised) / BCA (Revised)

Term-End Examination

December, 2015

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours

Maximum Marks : 50

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

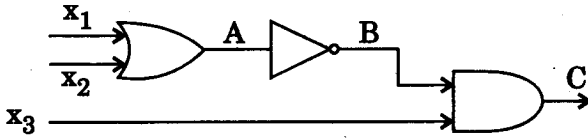
1. (a) Write the truth value of the disjunction of "The earth is flat" and " $3 + 5 = 2$ ". 2
- (b) If p and q are two propositions, then show that $\sim(p \vee q) \equiv \sim p \wedge \sim q$. 4
- (c) Use Mathematical induction to prove that 4
- $$1 + \frac{1}{4} + \frac{1}{9} + \dots + \frac{1}{n^2} \leq 2 - \frac{1}{n} \quad \forall n \in \mathbb{N}.$$
- (d) If $f : \mathbb{R} \rightarrow \mathbb{R}$ is a function such that $f(x) = 3x + 2$, prove that f is one-one onto. Also, find the inverse of f . 4
- (e) How many integers between 100 and 999 consist of distinct even digits? 3

- (f) Show that the number of words of length n on an alphabet of m letters is m^n . 3
2. (a) Prove that :

$$\frac{\binom{n+1}{r}}{\binom{n+1}{r+1}} = \frac{r+1}{n+1}$$
 5
- (b) Express the Boolean expression in three variables $(x + y' + z')(xy + x'z)$ in DNF. 5
3. (a) Two dice, one red and one white, are rolled. What is the probability that the white die turns up a smaller number than the red die ? 4
- (b) State and explain De Morgan's law for Boolean algebra. Also, explain duality principle with the help of an example. 4
- (c) In how many distinct ways is it possible to seat eight persons at a round table ? 2
4. (a) Use Mathematical induction to prove that 4

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6} \quad \forall n \in \mathbb{N}.$$

- (b) Find the Boolean expression C for the following logic circuit : 4



- (c) Prove the following equivalence : 2
- $$\sim \forall x P(x) \equiv \exists x \sim P(x)$$
5. (a) Verify that $p \wedge q \wedge \sim p$ is a contradiction and $p \rightarrow q \leftrightarrow \sim p \vee q$ is a tautology. 5
- (b) Show that $\sqrt{2}$ is irrational. 5
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