MCA (Revised)

Term-End Examination

December, 2008

MCS-013 : DISCRETE MATHEMATICS

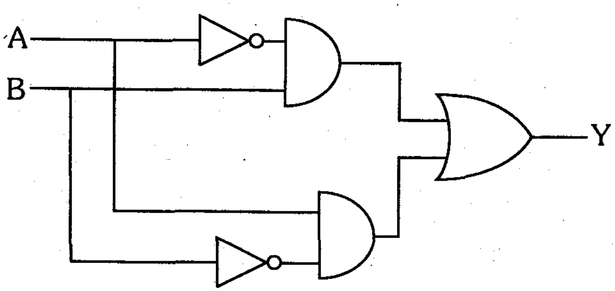
Time : 2 hours *Maximum Marks : 50*

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

1. (a) Show that

$((p \vee \sim q) \wedge (\sim p \vee \sim q)) \vee q$ is a tautology. 3

(b) Find the Boolean expression for the circuit



3

(c) Show that $n^2 > 2n + 1$ for $n \geq 3$ by Mathematical Induction. 4

(d) In a class of 80 students, 50 students know English, 55 know French and 46 know German. 37 know English and French, 28 know French and German, 7 students know none of the languages. Find how many students know exactly 2 languages. 4

(e) For the set $A = \{1, 2, 3, 4\}$, let R be a relation on A defined as

$$R = \{(1, 2), (1, 3), (2, 4), (3, 2)\}.$$

Find whether (i) R is reflexive (ii) R is symmetric (iii) R is transitive. 3

(f) Let $f : R \to R$, $g : R \to R$ be defined by $f(x) = x + 1$, $g(x) = 2x^2 + 3$. Then find $(fog)(x)$ and $(gof)(x)$. 3

2. (a) Show that contrapositives are logically equivalent, i.e. $p \to q \equiv \sim p \to \sim q$. 3

(b) X is a family of sets and R is a relation on X, defined by "x is subset of y". Find whether the relation R is : (i) symmetric and (ii) transitive. 4

(c) If $A = \{a, b\}$, $B = \{p, q, r\}$, then find $A \times B$ and $B \times A$. 3

3. (a) Make a truth table for the boolean expression :

$$p \wedge (p \to q)$$

Further, from the table, find DNF for the expression. 5

(b) Prove that $A - B = A \cap B'$. 3

(c) Convert each of the following into language of symbols : 2

(i) Ram and Abdul are fond of football.

(ii) If it rains then I take the umbrella with me.

4. (a) For $f : R \to R$,

$$f(x) = \begin{cases} 3x - 4, & x > 0 \\ -3x + 2, & x \leq 0 \end{cases}$$

Find $f^{-1}(0)$. 4

(b) How many five digit numbers are even ? How many five digit numbers are composed of only odd digits ? 3

(c) Consider the set {a, b, c, d}. In how many ways can two letters be selected out of these letters when repetition is allowed ? 3

5. (a) Show that

$(p \wedge (\sim p \vee q)) \vee (q \wedge \sim(p \wedge q)) \equiv q$. 4

(b) Find the number of ways of placing 8 similar balls in 5 numbered boxes. 3

(c) Show that $\sqrt{7}$ is an irrational number. 3