MCS-013

MCA (Revised) / BCA (Revised)
Term-End Examination
December, 2014

01204

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) Let A = {a, b, c, d}, B = {1, 2, 3} and R = {(a, 2), (b, 1), (c, 2), (d, 1)}. Is R a function ? Why ? *3*

   (b) Under what conditions on sets A and B, $A \times B = B \times A$? Explain. *3*

   (c) How many bit strings of length 8 contain at least four 1s ? *3*

   (d) Show that the proposition $p \to q$ and $\sim p \vee q$ are logically equivalent ? *2*

   (e) Use mathematical induction to show that $n! \geq 2^{n-1}$ for $n \geq 1$. *3*

   (f) A coin is tossed n times. What is the probability of getting exactly r heads ? *3*

   (g) Prove that if x and y are rational numbers, then x + y is rational. *3*

2. (a) Find f^{-1}, where f is defined by $f(x) = x^3 - 3$ where $x \in R$. *5*

(b) Let the set $A = \{1, 2, 3, 4, 5, 6\}$ and R is defined as $R = \{(i, j) \mid |i - j| = 2\}$. Is 'R' transitive ? Is 'R' reflexive ? Is 'R' symmetric ? *5*

3. (a) What are the inverse, converse and contrapositive of the implication "If today is holiday then I will go for a movie." ? *3*

(b) Draw the logic circuit for

$$Y = AB'C + ABC' + AB'C'$$ *4*

(c) In how many ways can a prize winner choose three books from a list of 10 bestsellers, if repeats are allowed ? *3*

4. (a) What is understood by the logical quantifiers ? How would you represent the following propositions and their negations using logical quantifiers : *5*

(i) There is a lawyer who never tells lies.

(ii) All politicians are not honest.

(b) Show that

$$(\sim p \wedge (\sim q \wedge r)) \vee (q \wedge r) \vee (p \wedge r) \Leftrightarrow r$$ *3*

(c) Define Modus Tollens. *2*

5. (a) If R is the set of all real numbers, then show that a map $g : R \rightarrow R$ defined by $g(x) = x$ for $x \in R$ is a bijective map. *4*

(b) Let $A = \{1, 2, 3, 4\}$ and

$$f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 1 & 3 \end{pmatrix}$$

$$g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 1 & 2 & 3 \end{pmatrix}.$$

Find fog and gof. *4*

(c) A club has 25 members. How many ways are there to choose four members of the club to serve on an executive committee ? *2*
