

**MCA (Revised)**  
**Term-End Examination**  
**June, 2007**

**MCS-013 : DISCRETE MATHEMATICS**

Time : 2 hours

Maximum Marks : 50

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

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1. (a) A question bank has  $m$  questions of type I,  $n$  questions of type II and  $p$  questions of type III. A question paper consisting of 3 sections is created by randomly picking 15 questions of type I for Section A, 10 questions of type II for Section B and 5 questions of type III for Section C. If 2 question papers have to be created with none of the questions being repeated, find a formula in terms of  $m$ ,  $n$  and  $p$  for the number of ways in which this can be done. 3
- (b) Show that  $(\sim q \wedge (p \rightarrow q)) \rightarrow \sim p$  is a tautology using truth table. 3
- (c) Find the number of permutations of the word 'BANDANA' in which no more than 2 As are together. 3

- (d) In how many ways can 6 men and 6 women sit on a round table, if each woman and each man sits alternately? What will be number of ways if it is a single line of alternate man and woman? 3

(e) Let  $f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 1 \end{pmatrix}$  and

$g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 1 & 2 \end{pmatrix}$ . Check whether  $f$  and  $g$

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

$f(1) = 2, f(2) = 3$  and so on. 3

- (f) Show  $A \oplus B$  using Venn diagram.  
( $A \oplus B$  is the symmetric difference) 2

- (g) Draw the logic circuit for the boolean expression  $((x'_1 \wedge x_2) \vee (x_2 \wedge x'_3))'$ . 3

2. (a) Express the following statement using logical quantifiers and logical connectives :

'An applicant is admitted into the MBA programme if the applicant clears the entrance examination and has either a post graduate degree or has worked in a supervisory capacity for at least 3 years.'

Write also the contrapositive. 4

- (b) For  $n \geq 3$ , prove

$1^2 + 2^2 + 3^2 + \dots + b^2 = \frac{b}{6} (b + 1) (2b + 1)$  3

- (c) Define equivalence relation. Let  $A$  be a set and  $R$  be the equivalence relation on  $A$ . Define  $A/R$  with the help of example. 3

3. (a) Determine the validity of the following argument using a truth table : 6

If the train arrives late and there are no taxis in the station, Farida is late for her meeting. Farida is not late for the meeting. The train did arrive late. Therefore, there were taxis at the station.

- (b) A die is rolled twice and the sum of the numbers that appear is observed. What is the probability that the sum is either a perfect square or a perfect cube ? 4

4. (a) Fill the missing entries in the following truth table : 4

$p$	$q$	$p \vee q$	$\sim(p \wedge q)$
		T	F
T			T
F		T	
F		F	

- (b) State the distributive properties for sets. Verify any one of them for  $A = \{1, 2, 3, 4\}$ ,  $B = \{3, 4, 5\}$  and  $C = \{1, 2, 5\}$ . 3

- (c) If 50 balls are put in 11 different boxes, show that at least two boxes have the same number of balls. 3

5. (a) For the function below, find Boolean expressions in CNF and DNF.

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$x_1$	$x_2$	$x_3$	$f(x_1, x_2, x_3)$
1	1	1	1
1	0	1	0
0	1	1	0
1	1	0	0
1	0	0	1
0	1	0	1
0	0	1	1
0	0	0	0

- (b) Check whether the boolean expressions  $(x_1 \wedge x_2') \vee x_3$  and  $(x_1 \vee x_2) \wedge x_3'$  are equivalent. (Use truth table)

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- (c) 10 persons arrived at a meeting venue carrying identical brief-cases. When they left after the meeting they found on checking that 5 of them got back their own brief-case from the reception while none of the remaining 5 got back their own brief-cases. In how many ways can this happen ?

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