PG – 448

I Semester M.C.A. Degree Examination, January 2017
(CBCS)
COMPUTER SCIENCE
MCA – 104T : Discrete Mathematics

Time : 3 Hours Max. Marks : 70

***Instruction** : Answer **any 5** questions from Part – **A** and **any 4** from Part – **B**.*

PART – A

Answer **any five** questions. **Each** question carries **six** marks. **(5×6=30)**

1. a) Determine the sets A and B, given that $A - B = \{1, 3, 7, 11\}$, $B - A = \{2, 6, 8\}$, $A \cap B = \{4, 9\}$.

   b) For any three sets A, B and C, prove that $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$. **(3+3)**

2. Let $A = \{1, 2, 3, 4, 6\}$ and R be the relation on A defined by aRb if and only if "a is a multiple of b".
   i) Write down R as a set of ordered pairs
   ii) Represent R as a matrix
   iii) Draw the diagraph of R. **6**

3. a) Define the terms (i) Rule of Syllogism (ii) Modus pones (iii) Modus Tollens.

   b) Let p and q be primitive statements for which the conditional $p \to q$ is false. Determine the truth value of the following compound propositions

   i) $p \wedge q$ ii) $\sim p \vee q$ iii) $\sim q \to \sim p$ **(3+3)**

4. Prove by mathematical induction that for every positive integer $n > 2$, "$n! > 2^{n-1}$". **6**

5. A husband and wife appear in an interview for two vacancies in the same post. The probability of husband's selection is 1/7 and that of wife's selection is 1/5. What is the probability that (i) Both of them will be selected (ii) Only one of them will be selected (iii) None of them will be selected. **6**

6. Prove that the set of all real numbers in the open interval (0, 1) is uncountable. **6**

7. Let A and B be any two nonempty sets. (i) Define a function from A to B (ii) one-to-one function (iii) onto function. If $n(A) = 7$ and $n(B) = 4$, find the number of functions from A to B and one to one functions from A to B. 6

8. a) Define simple graph, complete graph, regular graph with an example.

b) Show that the hyper cube Q_3 is a bipartite graph. (3+3)

PART – B

Answer **any four** questions. **Each** question carries **10** marks. (4×10=40)

9. a) Using Venn diagram, prove that $A \Delta (B \wedge C) = (A \Delta B) \Delta C$.

b) The MCA course of an University has 300 students. It is known that 180 can programme in Pascal, 120 can programme in Fortran, 30 in C++, 12 in Pascal and C++, 18 in Fortran and C++, 12 in Pascal and Fortran and 6 in all three languages.

i) A student is selected at random, what is the probability that the student can programme in exactly two languages ?

ii) Two students are selected at random what is the probability that both can programme in Pascal ? Both programme only in Pascal ? (4+6)

10. a) Define R on A = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12} by $(x, y) \in R$ if $x - y$ is a multiple of 5.

i) Show that R is an equivalence relation on A.

ii) Determine the equivalence classes and partition of A induced by R.

b) Define the bijective function. If $f : R \to R$ and $g : R \to R$ where $f(x) = 3x + 7$ and $g(x) = x(x^3 - 1)$. Show that f is one to one but not g. (5+5)

11. a) Prove the validity of the following statement. If Ragini gets the supervisor's position and works hard, then she will get a raise. If she gets the raise, then she will buy a new car. She has not purchased a new car. Therefore either Ragini did not get the supervisor's position or she did not work hard.

b) Prove that $(p \to q) \wedge \left[-q \wedge (r \vee \sim q) \right] \Leftrightarrow \sim (q \vee p)$. (5+5)

12. a) State and prove the extended pigeon hole principle.

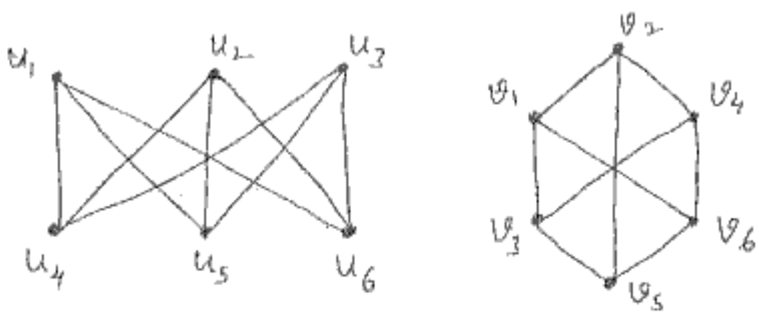
b) Shirts numbered consecutively from 1 to 20 are worn by students of a class. When any 3 of these students are chosen to be debating team from the class, the sum of their shirt numbers is used as the code number of the team. Show that if any 8 of the 20 are selected, then from these 8 we may form at least two different teams having the same code number. **(5+5)**

13. a) Solve the linear recurrence relation $a_n = 4a_{n-1} + 5a_{n-2}$ with $a_1 = 2$, $a_2 = 6$.

b) We must form a committee of eight people from two mathematicians and ten economists. In how many way can we do it, if the committee must include at least one mathematician ? **(5+5)**

14. a) Prove that, in any undirected graph, the number of odd degree vertices is even.

b) Verify that the two graphs shown below are isomorphic.



(5+5)

____