16050(D) - 0 DEC 201

B. Tech 3rd Semester Examination

Discrete Mathematics & Logic Design (NS)

NS-206A

Time : 3 Hours   Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Each question carries 20 marks. Attempt one question from each section A, B, C & D. Section E is compulsory and carries 20 marks.

SECTION - A

1. (a) If $R = \{(a, b), (b, c), (c, a)\}$ and $A = \{a, b, c\}$, then find reflexive, symmetric and transitive closure of R by the composition of relation R.

   (b) Let 100 of the 120 students of mathematics at a college take at least one of the languages Hindi, English and German. Also, let 65 study Hindi, 45 study English and 45 German. If 20 study Hindi and English, 25 study English and German and 15 study Hindi and German. Find the number of students who study all the three languages.
   (20)

2. (a) Prove $(A \cup B) \setminus (A \cap B) = (A \setminus B) \cup (B \setminus A)$

   (b) Write the dual of each statement:
   $(a \wedge b) \vee c = (b \vee c) \wedge (c \vee a); (b)(a \wedge b) \vee a = a \wedge (b \vee a)$

   (c) Let Dm denote the positive divisors of m ordered by divisibility. Draw the Hasse diagrams of:
   (a) D_{14}, (b) D_{15}, (c) D_{16}
   (20)

SECTION - B

3. (a) Show that the propositions $\neg(p \wedge q)$ and $\neg p \wedge \neg q$ are logically equivalent.

   (b) Find the number n of distinct permutations that can be formed from all the letters of each word:

   (a) THOSE   (b) UNUSUAL   (c) SOCIOLOGICAL.   (20)

4. (a) Examine the validity of the following argument. "If prices are higher then wages are high prices are high or there are price controls. If there are price controls then there is not an inflation. There is an inflation therefore wages are high.

   (b) Verify that the proposition $(p \wedge q) \wedge \neg(p \vee q)$ is a contradiction.   (20)

SECTION - C

5. (a) Define group, monoids, semigroups and subgroups.

   (b) G_1 and G_2 are two subgroups of a group G then prove that $G_1 \cap G_2$ is also a subgroup of G.

   (c) For a Group G prove that G is abelian iff $(ab)^2 = a^2b^2$ for all $a, b \in G$ (20)

6. (a) Consider the group $G = \{1, 2, 3, 4, 5, 6\}$ under multiplication modulo 7.

   (b) Define multiplication table of G.

   (c) Find $2^{-1}, 3^{-1}, 6^{-1}$.

   (d) Define orders and subgroups generated by 2 and 3.

   (e) Is group cyclic?   (20)

[P.T.O.]

SECTION - D

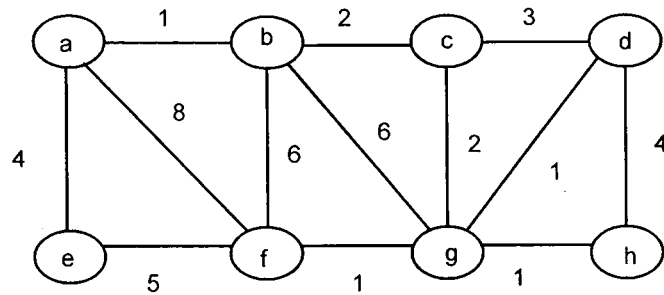7. (a) Find out MST of graph in Fig. 1 using prims and kruskal algorithm

Fig. 1

(b) Show that a connected graph G with n vertices must have at least n – 1 edges. (20)

8. (a) Define Graph. Discuss various memory representations technique used for graph with the help of an example.

(b) Insert these keys 15, 32, 20, 9, 3, 25, 12, 1 into binary search one by one and Show the binary search tree after each insertion. (20)

SECTION - E

9. Define all with the examples:

(i) Countable and uncountable sets.

(ii) Isomorphic ordered sets.

(iii) Universal and existential quantifiers.

(iv) Recurrence relations.

(v) Post order tree traversal. (5×4=20)