ROLL NO. _____

Code: CT22 Subject: DISCRETE MATHEMATICAL STRUCTURES

ALCCS – NEW SCHEME

Time: 3 Hours **FEBRUARY 2013** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE:

- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
- **Parts of a question should be answered at the same place.**

Q.1 a. Show that $(\sim P \wedge (\sim Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$

b. If a = b then prove that $ab' + a'b = 0$.

c. Draw the graph G, whose adjancy matrix is given as:

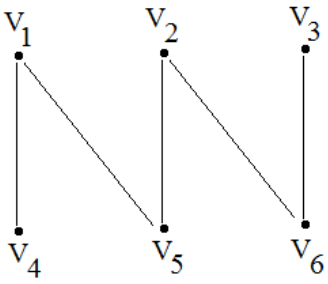
$$A = \begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \end{array} \begin{array}{c} \begin{array}{ccccc} V_1 & V_2 & V_3 & V_4 & V_5 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

d. Draw the connected regular graphs of degree 0, 1 and 2.

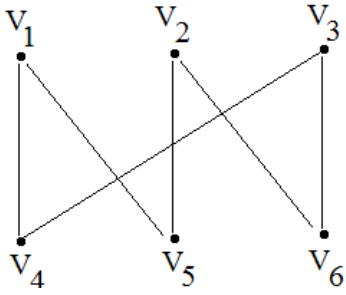
e. What is tree? Define the m-way tree with suitable example.

f. Which of the following graphs are trees:-

(i)



(ii)



g. State pigeon hole principle. Explain using a suitable example. **(7 × 4)**

Q.2 a. Determine the number of integers between 1 and 250 that are divisible by any of the integers 2, 3, 5 and 7. **(9)**

b. Show that $1^2 - 2^2 + 3^2 + ... + (-1)^{n+1} n^2 = \frac{(-1)^{n+1} n^{(n+1)}}{2}$ **(9)**

Q.3 a. Write each of the following in disjunctive normal form **(9)**

(i) $(x + y)(x' + y')$

(ii) $x'z + xz'$

(iii) x

b. Let A = (2,3,4,5). Consider the relation B and C on a set A defined by

$B = [(2,2),(2,3),(2,4),(2,5),(3,4),(3,5),(4,5),(5,3)]$ and

$C = [(2,3),(2,5),(3,4),(3,5),(4,2),(4,3),(4,5),(5,2),(5,5)]$

then find

(i) $B_O C$

(ii) $C_O B$ **(9)**

Q.4 a. Let A = {1,2,3} and consider the two relations

R = {(1,1), (1,2), (1,3), (2,2), (3,3)}

S = {(1,1), (1,2), (2,2), (3,2), (3,3)}

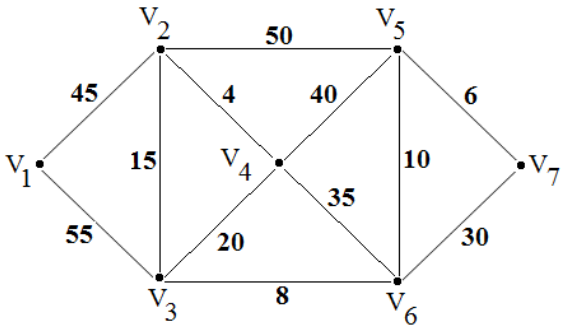
Then find $R^{-1}, R \cup S$ and $R \cap S$ by representing the matrices for R and S. **(9)**

b. Show that the operations of meet and join on a lattice are commutative, associative and idempotent. **(9)**

Q.5 a. "A Boolean algebra is a complemented, distributive lattice" Justify the statement. **(5)**

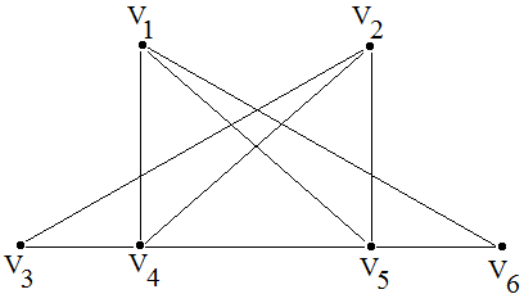
b. Let S = {a, b, c}. Draw the diagram of $(P(S), \subseteq)$. **(4)**

c. Find the shortest path from V_1 to V_7 in the following weighted graph: **(9)**

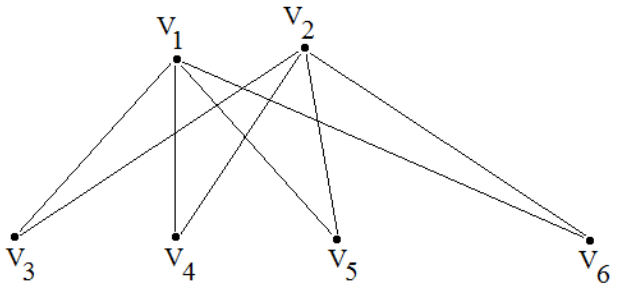


Q.6 a. What is planar graph? Check if the following graphs are planar graph. **(9)**

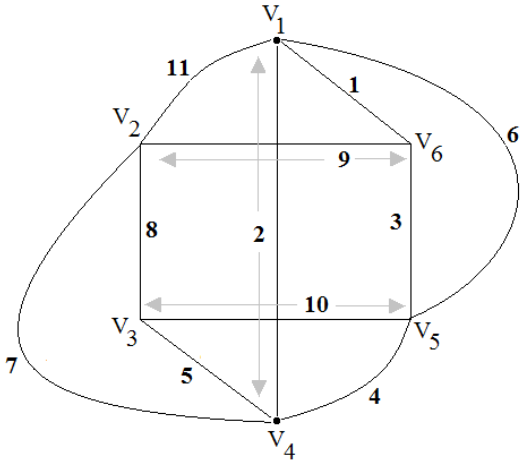
(i)



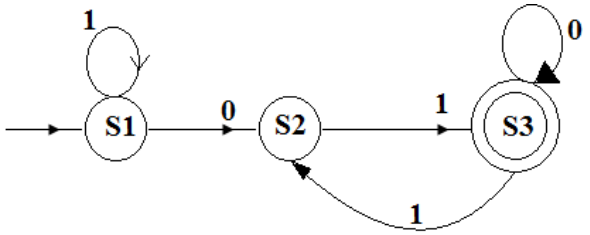
(ii)



b. Determine the minimal spanning tree for the graph given below using Krushal's algorithm. **(9)**



Q.7 a. Describe the language L = L(M) accepted by DFA whose transition graph is shown in the figure: **(9)**



b. Design a DFA to accept the language L = {u : u has both even number of 0's and even number of 1's}. Check whether this DFA accepts 110101. **(9)**