ROLL NO. _____

Code: CT22 Subject: DISCRETE MATHEMATICAL STRUCTURES

ALCCS

Time: 3 Hours **JUNE 2017** **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. Determine the values of the following prefix expressions. ($\uparrow$ is exponentiation.)
+, -, $\uparrow$, 3, 2, $\uparrow$, 2, 3, /, 6, –, 4, 2

b. If A,B,C are finite sets, prove the extended addition principle
$|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |B \cap C| - |A \cap C| + |A \cap B \cap C|$

c. Prove that, any connected graph with minimum numbers of edges will form a tree.

d. Is the statement 'If p then q' with given p and q, false or true?
p: Ravana was the king of Ayodhya
q: Mandodari was Ravana's wife.

e. Prove that the total degree of a graph is always an even number.

f. What do you mean by the term contradiction? Check if the following statement is a contradiction?
"If the sky is cloudy then it will rain and it will not rain"

g. Obtain the values of the Boolean forms
$x_1 * (x_1' \oplus x_2)$, $x_1 * x_2$ and $x_1 \oplus (x_1 * x_2)$
over the ordered pairs of the two element Boolean algebra. **(4×7)**

Q.2 a. Prove that : $p \rightarrow (q \rightarrow r)$ and $(p \wedge \neg r) \rightarrow \neg q$ are logically equivalent. **(9)**

b. Check the validity of the argument: **(9)**

$$\frac{\begin{array}{l} p \Rightarrow q \\ r \Rightarrow \neg q \end{array}}{p \Rightarrow \neg r}$$

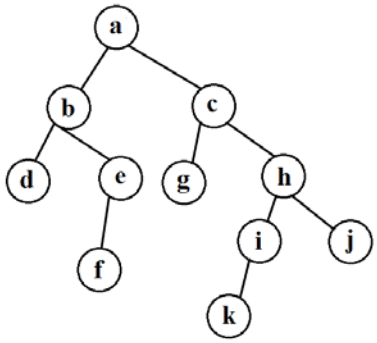
Q.3 a. Define symmetric, asymmetric and antisymmetric relations giving example in each category. **(6)**

b. Show that if $R1$ and $R2$ are equivalence relations on A, then $R1 \cap R2$ is an equivalence relation. **(6)**

c. Show that the maximum number of vertices in a binary tree of height h is $2^{h+1}-1$. **(6)**

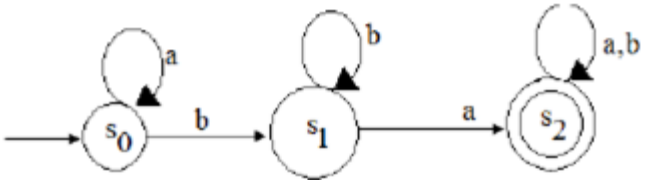
Q.4 a. Construct a finite automata to accept all the strings of odd lengths on the alphabet {a,b,c}. **(6)**

b. Traverse the tree using **(6)**
(i) Preorder traversal (ii) Inorder traversal (iii) Post order traversal



c. If $A \subseteq C$ and $B \subseteq D$, prove that $A \times B \subseteq C \times D$ **(6)**

Q.5 a. Describe the word w in the language L accepted by automation M in the figure below: **(9)**

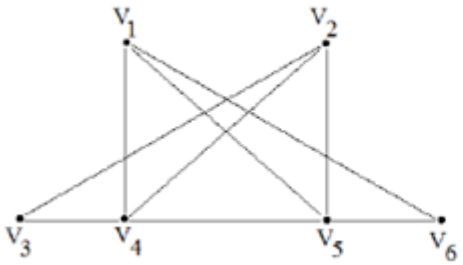


b. What is a Hasse diagram? Draw the Hasse diagrams of the following sets under the partial ordering relation "divides" and indicate those which are totally ordered. **(9)**
(i) {2, 6, 24} (ii) {1, 2, 3, 6, 12} (iii) {3, 9, 27, 54}

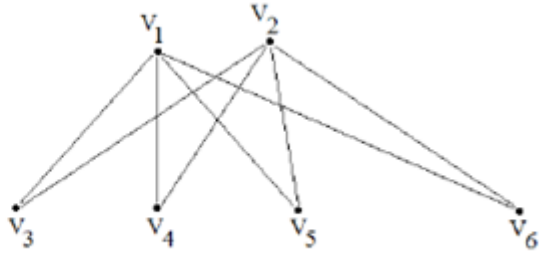
Q.6 a. Show that $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow s)] \rightarrow (s \vee r)$ is a tautology. **(9)**

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

(i)



(ii)



Q.7 a. Write down the Warshall's algorithm for the connectivity amongst the vertices of the graph. **(9)**

b. Determine the values of the following prefix notation: **(4)**
+, -, -, 3, 2, -, 2, 3, /, 6, −, 4, 2

c. Find the state table for the NFA with the state diagram given below. **(5)**