

MAY 2013

P/ID 17401/RBA

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Time : Three hours

Maximum : 75 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

All questions carry equal marks.

1. (a) Show that

$$\left(\neg P \wedge \left(\neg q \wedge r\right)\right) \vee (q \wedge r) \vee (p \wedge r) \Leftrightarrow R.$$

Or

(b) Determine the validity of the following argument: If 7 is less than 4, then 7 is not a prime number

$$\frac{7 \text{ is not less than } 4}{7 \text{ is a prime number}}.$$

2. (a) Prove that

$$A \cup B = (A \cup \sim B) \cup (B \cap \sim A) \cup (A \cap B)$$

Or

- (b) Determine the types of relations for the following matrices.

(i) 
$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(ii) 
$$\begin{bmatrix} 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$$

(iii) 
$$\begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

3. (a) Define monoid homomorphism. Give an example.

Or

- (b) Define

(i) Subgroup

(ii) Kernal

(iii) Normal subgroup.

4. (a) Write short notes on reachability matrix of a graph with an example.

Or

- (b) Write an algorithm for pre order traversal of a binary tree.

5. (a) Define
- (i) Precedence relation.
  - (ii) Reduced grammar.
- Or
- (b) Write short notes on parsing.  
PART B — (5 × 10 = 50 marks)  
Answer any FIVE questions.  
All questions carry equal marks.
6. (a) Construct the truth table for  $(q \wedge (p \rightarrow q)) \rightarrow p$ . (5)
- (b) Use laws of proposition to prove  $((p \vee q) \wedge \neg(\neg p \wedge (\neg q \vee \neg r))) \vee (\neg p \wedge \neg q) \vee (\neg p \wedge \neg r)$  is a tautology. (5)
7. (a) Without constructing the truth tables, find the principal disjunctive normal form for the statement  $(\neg p \rightarrow q) \wedge (q \Leftrightarrow p)$ . (5)
- (b) Show that  $r \rightarrow s$  can be derived from the premises  $p \rightarrow (q \rightarrow s)$ ,  $\neg r \vee p$  and  $q$ . (5)
8. (a) Give  $A = \{2,5,6\}$ ,  $B = \{3,4,2\}$ ,  $C = \{1,3,4\}$ , Find  $A - B$ ,  $B - A$  and  $A - C$ . (3)
- (b) Prove that  $(A \cap B) \times (C \cap D) = (A \times C) \cap (B \times D)$ . (7)

9. (a) Let  $f(x) = x + 2$ ,  $g(x) = x - 2$  and  $h(x) = 3x$  for  $x \in R$ , where  $R$  is the set of real numbers. Find
- (i)  $g \circ f$
  - (ii)  $h \circ g$
  - (iii)  $(f \circ h) \circ g$ . (5)
- (b) Write a recursive function for calculating the greatest common division. Using it, calculate the  $\text{gcd}(20,6)$ . (5)
10. Explain the algorithm for converting the given infix expression into a polish notation with an example.
11. (a) Prove that the kernel of a homomorphism  $g$  from a group  $\langle G, * \rangle$  to  $\langle H, S \rangle$  is a subgroup of  $\langle G, * \rangle$ . (5)
- (b) Write short notes on the notations of syntax analysis. (5)
12. Write a detailed note on the list structures and graphs.
13. Discuss the procedure for the detection of faults with an example.
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