MAY 2013

P/ID 17504/PCASD

Time : Three hours Maximum : 100 marks

PART A — ($6 \times 5 = 30$ marks)

Answer any SIX questions.

All questions carry equal marks.

1. Define disjunction. Construct Truth table for disjunction of two statements.

2. Obtain conjunctive normal forms of

   (a) $P \wedge (P \rightarrow Q)$

   (b) $\neg(P \vee Q) \rightleftarrows (P \wedge Q)$.

3. What is binary relation? State its reflexive and transitive properties.

4. If $A = \{1, 2, \ldots, n\}$, show that any function from A to A, which is one-to-one must also be onto and conversely.

5. When do you say that a semi-group is monoid? Study whether $< E, + >$ is a monoid, if E represents the set of positive even numbers.

6. Find a real root of the equation $x^3 - x - 1 = 0$ applying the method of bisection.

7. Evaluate $\int_0^1 \frac{1}{1+x}\,dx$ correct to three decimal places applying Simpson's 1/3rd rule with $h = 0.25$.

8. Explain the application of second-order Runge-Kutta method of solving differential equations.

PART B — (7 × 10 = 70 marks)

Answer any SEVEN questions.

All questions carry equal marks.

9. Without constructing the truth table obtain the product of sums canonical form of the formula $(\neg P \to R) \wedge (Q \leftrightarrow P)$. Hence find the sum of products canonical form.

10. Show that

(a) $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \to R) \wedge (Q \to S)$.

(b) $R \to S$ can be derived from the premises $P \to (Q \to S)$, $\neg R \vee P$ and Q.

11. (a) Show that the function $f(x) = x/2$ is a partial recursive function.

(b) When do you say a function is primitive recursive? Verify this property to the function $[\sqrt{x}]$ which is the greatest integer $\leq \sqrt{x}$.

12. Write down a recursive PL/1 program for the factorial function. Give your comments on the procedure.

13. Describe the REVPOL algorithm of converting an infix expression into reverse polish.

14. Prove that monoid homomorphism preserves invertibility and monoid epimorphism preserves zero element (if it exists).

15. Solve the equations $2x + 3y + z = 9$, $x + 2y + 3z = 6$, $3x + y + 2z = 8$ by LU decomposition method.

16. Illustrate the application of Romberg's method of numerical integration with evaluating $\int_0^1 \frac{1}{1+x}\,dx$ correct to three decimal places.

17. Obtain explicit predictor-corrector formulae using Newton's backward difference interpolation formula.

18. Use the Fourth order R.K. method to compute y for $x = 0.1$, given $y' = \frac{xy}{1+x^2}$, $y(0) = 1$, take $h = 0.1$.