DECEMBER 2014

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 conjunction, construct Truth table for conjunction of two statements.

2. Show that :

   $\left(\neg P \wedge \left(\neg Q \wedge R\right)\right) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$.

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

4. 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 $g \circ f; f \circ g; f \circ f; g \circ g;$ and $f \circ h \circ g$.

5. Prove that for any commutative monoid <M, *>, the set of idem potent elements of M forms a sub monoid.

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

7. Evaluate $\int_0^1 \frac{1}{1+x} dx$ correct to three decimal places applying trapezoidal rule with $h = 0.25$.

8. Given $dy/dx = y - x$ where $y(0) = 2$, find $y(0.1)$ and $y(0.2)$ correct to four decimal places. Using Runge-Kutta second order method.

PART B — (7 × 10 = 70 marks)

Answer any SEVEN questions.

9. Obtain the principal conjunctive normal form of the formula S given by $(\neg P \to R) \wedge (Q \rightleftarrows P)$.

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

(b) Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q, Q \to R$, $P \to M$ and $\neg$M.

11. (a) Show that the function $[x/2]$ which is equal to the greatest integer which is $\leq x/2$ is primitive recursive.

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

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

13. Describe the BASIC, algorithm of converting on infix expression into reverse polish.

14. The language $L(G_3) = \{a^n b^n c^n / n \geq 1\}$ is generated by the following grammar $G_3 = \{\{S, B, C\}, \{a, b, c\}, S, \phi\}$ where ϕ consistent of productions $S \to aSBC; S \to aBC; CB \to BC;$ $aB \to ab; bB \to bb; bC \to bc, cC \to cc.$

Find the derivation for the string $a^2b^2c^2$.

15. Solve the equation $2x + 3y + z = 9$; $x + 2y + 3z = 6$; $3x + y + 2z = 8$ 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. Use the Runge-Kutta method of fourth order, find $y(0.2), y(0.4)$ and $y(0.6)$, where $y' = 1 + y^2, y(0) = 0$, Take $h = 0.1$.

18. Find $y(0.1), y(0.2), y(0.3)$ from $dy/dx = xy + y^2$, $y(0) = 1$ by using R.K.Method of IVth order and hence obtain $y(0.4)$ using Adam's Predictor method.
