

MAY 2016

P/ID 17504/PCASD

Time : Three hours

Maximum : 100 marks

PART A — ($6 \times 5 = 30$ marks)

Answer any SIX questions.

1. Write the following statement in symbolic form. If either Jemy takes calculus or ken takes sociology, then Larry will take English.
2. Obtain disjunctive normal forms of
 - (a) $P \wedge (P \rightarrow Q)$
 - (b) $\neg(P \vee Q) \Leftrightarrow (P \wedge Q)$
3. Show that for any two sets A and B
 $A - (A \cap B) = A - B$.
4. Let $R = q\langle 1, 2 \rangle, \langle 3, 4 \rangle, \langle 2, 2 \rangle$ and $S = \{\langle 4, 2 \rangle, \langle 2, 5 \rangle, \langle 3, 1 \rangle, \langle 1, 3 \rangle\}$. Find $R \circ S$, $S \circ R$, $R \circ (S \circ R)$, and $R \circ (R \circ R)$.
5. Define the following terms : semigroup, monoids and phrase structure grammar.
6. Find the positive root of the equation $xe^x = 1$ which lies between 0 and 1, upto 5 stage.

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

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

PART B — (7 × 10 = 70 marks)

Answer any SEVEN questions.

9. (a) Show that

$$((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))) \vee$$

$$(\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R) \text{ is a tautology.}$$

(b) Obtain the principal conjunctive normal form of the formula S given $(\neg P \rightarrow R) \wedge (Q \Leftrightarrow P)$.

10. (a) Show that $R \vee S$ follow logically from the premises $C \vee D$, $(C \vee D) \rightarrow \neg H$, $\neg H \rightarrow (A \wedge \neg B)$ and $(A \wedge \neg B) \rightarrow (R \vee S)$.

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

11. Let $X = \{1, 2, 3, 4, 5, 6, 7\}$ and $R = \{ \langle x, y \rangle / x - y \text{ is divisible by } 3 \}$. Show that R is an equivalence relation. Draw the graph of R .
12. Write down a recursive PL/I program for the factorial function. Give your comments on the procedure.
13. Explain Polish expressions with an example.
14. (a) Define context-free grammar.
(b) The language $L(G_3) = \{a^n b^n c^n / n \geq 1\}$ is generated by the following grammar $G_3 = \langle \{S, B, C\}, \{a, b, c\}, S, \phi \rangle$ where ϕ consists of productions $S \rightarrow aSBC$;
 $S \rightarrow aBC$; $CB \rightarrow BC$; $aB \rightarrow ab$; $bB \rightarrow bb$;
 $bc \rightarrow bc$; $cC \rightarrow cc$.

Find the derivation for the string.

15. Solve the equation

$$2x + 3y + z = 9$$

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

by the factorization method.

16. Use Romberg's method to compute $I = \int_0^1 \frac{1}{1+x} dx$,
correct to three decimal places are write the
application of Romberg's method of numerical
integration.
17. Using Runge-Kutta method of fourth order, find
 $y(0.1), y(0.2)$ where $y' = y - x$. Take $h = 0.1$.
18. Obtain explicit predictor-corrector formulae using
Newton's backward difference interpolation
formula.
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