

Total No. of Questions : 10]

SEAT No. :

P1357

[Total No. of Pages : 3

[4858] - 1105

T.E. (I.T.) (Semester - I)
THEORY OF COMPUTATION
(2012 Pattern) (End Sem.)

Time : 2½ Hour]**[Max. Marks : 70****Instructions to the candidates:**

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicates full marks.*
- 3) *Assume suitable data, if necessary.*

Q1) a) Design an FA for the languages that contain strings with next-to-last symbol O. [5]

b) Write formal definition of NFA - Λ . Also define Λ - closure. [5]
 OR

Q2) a) Draw an FA recognizing the regular language corresponding to give regular expression [5]

$$1(01 + 10)^* + 0(11 + 10)^*$$

b) Write a short note on the applications of Regular Expressions. [5]

Q3) a) State pumping Lemma for context - free languages. Also Define context - free language. [5]

b) Construct parse trees for the strings using specified derivation format for the given grammar G. [5]

$$G = (\{S, A, B\}, \{a, b\}, P, \{S\})$$

$$P = \{S \rightarrow aB \mid bA$$

$$A \rightarrow a|aS \mid bAA$$

$$B \rightarrow b \mid bS \mid aBB\}$$

Strings :

- i) aaabbb (rightmost derivation)
- ii) aababb (leftmost derivation)

P.T.O.

OR

Q4) a) Define [5]

- i) Ambiguous Grammar
- ii) Regular Grammar with suitable example.

b) Convert given CFG into Greibach Normal Form [5]

$$S \rightarrow ABA$$

$$A \rightarrow aA | \epsilon$$

$$B \rightarrow bB | \epsilon$$

Q5) a) Design a PDA which accepts only odd number of a's over $\Sigma = \{a, b\}$. Simulate PDA for the string "aabab". [9]

b) Define PDA and Post machine with suitable example. Compare DPDA, NPDA and CFG. [9]

OR

Q6) a) For the PDA $(\{q_0, q_1\}, \{0, 1\}, \{0, 1, z_0\}, \delta, q_0, z_0, \phi)$ where δ is [9]

$$\delta(q_0, \Lambda, z_0) = (q_0, \Lambda)$$

$$\delta(q_0, 0, z_0) = (q_0, 0, z_0)$$

$$\delta(q_0, 0, 0) = (q_0, 00)$$

$$\delta(q_0, 1, 0) = (q_0, 10)$$

$$\delta(q_0, 1, 1) = (q_0, 11)$$

$$\delta(q_0, 0, 1) = (q_1, \Lambda), \delta(q_1, 0, 1) = (q_1, \Lambda)$$

$$\delta(q_1, 0, 0) = (q_1, \Lambda)$$

$$\delta(q_1, \Lambda, z_0) = (q_1, \Lambda)$$

obtain CFG accepted by the above PDA.

b) Compare PDA and post machine. Design a post machine to accept the language $L = \{a^n b^{n+1} \mid n \geq 0\}$ [9]

Q7) a) Construct a TM for obtaining two's complement of a given binary number. Simulate TM for any string. [8]

b) Write a short note on : [8]

- i) Multi - tape TM
- ii) Universal TM

OR

Q8) a) Compare FM, PDA, PM and TM with respect to language, grammar, powerfulness and example. [8]

b) Design a turing machine that accepts the language of all strings which contain 'aba' as a substring. [4]

c) Discuss categories of problems based on solvability with suitable example. [4]

Q9) a) Write a note on each of the following : [8]

- i) Recursively enumerable language.
- ii) Recursive language.
- iii) Recursive Functions.
- iv) Partial Recursive function.

b) Write a short note on Encoding of Turing Machine. [8]

OR

Q10) a) Explain post-correspondence problem. [8]

Let $\Sigma = \{0, 1\}$ and let A & B defined as shown in the table. Find the post correspondence sequence of integers $i_1, i_2, i_3, \dots, i_m$ for $m \geq 1$ such that $wi_1, wi_2, \dots, wi_m = xi_1, xi_2, \dots, xi_m$.

| | A | B |
|-----|-------|------|
| i | wi | xi |
| 1 | 0 | 000 |
| 2 | 01000 | 01 |
| 3 | 01 | 1 |

b) Define decidability of problem with suitable example. Describe undecidable problems for context-free Grammar. [8]

