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]**

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

$P = \{S \rightarrow a\ B \mid b\ A$

$A \rightarrow a|aS \mid b\ AA$

$B \rightarrow b \mid b\ S \mid a\ BB\ \}$

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]**

$S \rightarrow ABA$

$A \rightarrow aA|\in$

$B \rightarrow bB|\in$

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 ....., i_m for $m \geq 1$ such that wi_1, wi_2, ..., $wi_m = xi_1, xi_2$, ..., 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]**

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