

[5353] - 591

T.E. (IT)

THEORY OF COMPUTATION

(2015 Pattern)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

Q1) a) Define pumping lemma. Prove that the language $L = \{a^n b^{n+1} | n > 0\}$ is non regular. [6]

b) Construct FSM for divisibility by 3 tester for binary number. [4]

OR

Q2) a) Construct the Mealy machine to accept strings ending with '00' or '11' over $\Sigma = \{0,1\}$. Convert Mealy Machine into equivalent Moore machine. [8]

b) If $L(r) = \{\epsilon, x, xx, xxx, xxxx, xxxxx\}$ What is r ? [2]

Q3) a) Simplify the following grammar [5]

$$S \rightarrow a | Xb | aYa$$

$$X \rightarrow Y | \epsilon$$

$$Y \rightarrow b | X$$

b) Write an equivalent left-linear grammar for the right-linear grammar which is defined as : [5]

$$S \rightarrow 0A | 1B$$

$$A \rightarrow 0C | 1A | 0$$

$$B \rightarrow 1B | 1A | 1$$

$$C \rightarrow 0 | 0A$$

P.T.O.

OR

Q4) a) Check whether or not the following grammar is ambiguous : if it is ambiguous, remove the ambiguity and write an equivalent unambiguous grammar $E \rightarrow E + E | E - E | E * E | E / E | (E) | id$ [6]

b) Convert the given CFG $G = (\{s\}, \{a\}, p, s)$ into CNF. [4]

$S \rightarrow aaaaaS | aaa$

Q5) a) Construct PDA to accept the strings containing equal no. of a 's & b 's over $\Sigma = \{a, b\}$ [8]

Write ID for

i) $abbaab.$

ii) $aabb.$

b) Design a PM that checks if the given string contains well-formed parenthesis. [8]

Simulate for

$(()())$

OR

Q6) a) Construct a PDA that accepts the language $L = \{a^n b^m a^n | m, n \geq 1\}$. [8]

Write ID for

i) $aabbbaa.$

ii) $abbba$

b) Construct PDA for the following language [8]

$L = \{a^{2^n} b^n | n \geq 1\}$

- Q7) a)** Design a TM which compares two positive integers m & n and produces output Gt if $m > n$; Lt if $m < n$; and Eq if $m = n$; [12]

Write simulation for the input

- i) $m = 1, n = 2$.
 - ii) $m = n = 2$.
- b) Write short note on UTM. [6]

OR

- Q8) a)** Construct TM for the language $L = \{a^n b^n c^n \mid n > 0\}$. [10]
- b) Design a TM to find the value of $\log_2(n)$ where n is any binary number & a perfect power of 2. [8]

- Q9) a)** Prove that following are decidable languages. [10]

- i) $A_{CFG} = \{\langle G, W \rangle \mid G \text{ is a CFG that generates string } W\}$.
 - ii) $E_{CFG} = \{\langle G, W \rangle \mid G \text{ is CFG \& } L(G) = \emptyset\}$.
- b) Define the class P & Class NP problems with example. [6]

OR

- Q10) a)** Prove that [8]

$PCP = \{\langle P \rangle \mid P \text{ is an instance of the post correspondence problem with a match}\}$

is undecidable

- b) Explain Turing Reduciability with example. [8]

