

R15

Code No: 124AG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, May - 2017

FORMAL LANGUAGES AND AUTOMATA THEORY

(Computer Science and Engineering)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART-A

(25 Marks)

- 1.a) Define Transition Table. [2]
- b) Explain the difference between DFA and NFA. [3]
- c) Construct CFG to generate strings with any number of 1's. [2]
- d) Explain Leftmost Derivation with an example. [3]
- e) Construct PDA for the language  $L = \{a^m b^m c^n \mid m, n \geq 1\}$  [2]
- f) Define Ambiguity in CFG with an example. [3]
- g) Explain about Turing Machine. [2]
- h) Write a short note on Recursive languages. [3]
- i) List the properties of type-3 grammar. [2]
- j) Define Context-sensitive grammar. [3]

PART-B

(50 Marks)

- 2.a) Construct NFA with  $\epsilon$  which accepts a language consisting the strings of any number of 0's followed by any number of 1's followed by any number of 2's.
- b) Check whether the following two FSM's are equivalent. [5+5]

M1	0	1
$\rightarrow A$	B	D
(B)	A	C
C	D	B
(D)	C	A

M2	0	1
$\rightarrow P$	R	R
Q	R	P
(R)	P	Q

OR

- 3.a) Define Moore and Mealy machines with examples.
- b) Design FA to accept string with 'a' and 'b' such that the number of a's are divisible by 3. [5+5]
- 4.a) Construct the left linear grammar for the language  $(0+1)^*00(0+1)^*$ .
- b) Apply pumping lemma for the language  $L = \{a^n \mid n \text{ is prime}\}$  and prove that it is not regular. [5+5]

OR

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5. Design a FA for the following Languages

a)  $(0^*1^*)^*$

b)  $(0+1)^*111^*$

c)  $(0^*11^*+101)^*$

[3+3+4]

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6.a) Find the GNF equivalent to the following

$S \rightarrow AA \mid a$

$A \rightarrow SS \mid b$

b) Convert the following grammar to a PDA that accepts the language by empty stack

$S \rightarrow 0S1 \mid A$

$A \rightarrow 1A0 \mid S \mid \epsilon$

[5+5]

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OR

7.a) Eliminate Useless symbols from the following grammar

$S \rightarrow aA \mid a \mid Bb \mid cC$

$A \rightarrow aB$

$B \rightarrow a \mid Aa$

$C \rightarrow cCD$

$D \rightarrow ddd$

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b) Construct CFG for the PDA  $M = (\{q_0, q_1\}, \{0, 1\}, \{R, Z_0\}, \delta, q_0, Z_0, \Phi)$  and  $\delta$  is given by

$\delta(q_0, 1, Z_0) = (q_0, RZ_0)$

$\delta(q_0, 1, R) = (q_0, RR)$

$\delta(q_0, 0, R) = (q_1, R)$

$\delta(q_1, 0, Z_0) = (q_0, Z_0)$

$\delta(q_0, \epsilon, Z_0) = (q_0, \epsilon)$

$\delta(q_1, 1, R) = (q_1, \epsilon)$

[5+5]

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8.a) Design a Turing Machine to accept  $L = \{WW^R \mid W \text{ is in } (a+b)^*\}$ .

b) Design a TM to recognize the language  $L = \{1^n 2^n 3^n \mid n \geq 1\}$ .

[5+5]

OR

9.a) Design TM which will recognize strings containing equal number of 0's and 1's.

b) Design TM that accepts the language  $00^*$ .

[5+5]

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10.a) Explain Chomsky hierarchy of Languages.

b) Write short note on NP- hard and NP-complete problem.

[5+5]

OR

11.a) Discuss about universal turing Machine.

b) Define post's correspondence problem and show that it is undecidable.

[5+5]

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