

R16

Code No: 134BD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, December - 2018

FORMAL LANGUAGES AND AUTOMATA THEORY

(Common to CSE, IT)

Max. Marks: 75

Time: 3 Hours

**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 the central concepts of Automata Theory. [2]
- b) Write down the applications of finite automata. [3]
- c) Construct a regular grammar for  $L = \{0^n 11/n \geq 1\}$ . [2]
- d) Explain the applications of the pumping lemma. [3]
- e) Define ambiguity in CFG with an example. [2]
- f) Write short notes on Parse Trees. [3]
- g) Construct CFG to generate string with any numbers of 1's. [2]
- h) Write about the programming techniques for Turing Machines. [3]
- i) Define undecidability. Give an example of an undecidable problems. [2]
- j) Write short note on NP-hard problem. [3]

**PART-B**

(50 Marks)

- 2.a) Differentiate between NFA and DFA.
- b) Design DFA for the following over  $\{a, b\}$ 
  - i) All strings containing not more than three a's.
  - ii) All strings that has at least two occurrences of b between any two occurrences of a. [5+5]

**OR**

- 3.a) Explain the procedure for converting DFA to NFA.
- b) Briefly discuss about Finite Automata with Epsilon- Transitions. [5+5]
- 4.a) Define Regular Expression? Explain about the properties of Regular Expressions.
- b) Construct a DFA for the Regular expression  $(0+1)^*(00+11)(0+1)^*$ . [5+5]

**OR**

5. Design a FA for the following languages
  - a)  $(0^*1^*)^*$
  - b)  $(0+1)^*111^*$
  - c)  $(0^*11^* + 101)$

[10]

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

$S \rightarrow 0S1|A$

$A \rightarrow 1A0|S|\epsilon$ .

b) Show that for every PDA there exists a CFG such that  $L(G) = N(P)$ . [5+5]

OR

7.a) Derive left and right most derivations for the input string  $a=b*c+d/e$  for the given Grammar.

$E \rightarrow E+E|E-E|E*E$

$E \rightarrow E/E$

$E \rightarrow (E)|id$

b) Explain the followings with examples.

i) Sentential Forms

ii) Deterministic Pushdown Automata. [5+5]

8.a) Design a Turing Machine to accept the language  $L = \{wcw^R | w \in (a+b)^*\}$ .

b) Define Chomsky Normal Form (CNF). Convert the following grammar to CNF [5+5]

$S \rightarrow 0S0|1S1|\epsilon$

OR

9.a) Explain following:

i) Closure properties of Context Free Languages.

ii) Decision properties of Context Free Languages.

b) Design a Turing machine to recognize all strings consisting of odd numbers of 1's. [5+5]

10.a) Write the properties of recursive and non-recursive enumerable languages.

b) Let  $\epsilon = \{0,1\}$  and A,B be the list of 3 strings each. Verify below PCP has a solution or not? [5+5]

	List A	List B
1	wi	xi
1	00	0
2	001	11
3	1000	011

OR

11.a) Give the correspondence between P, NP and NP-complete problems.

b) Define post's correspondence problem and show that it is undecidable. [5+5]

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