

Code No: 155BK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, January/February - 2023

FORMAL LANGUAGES AND AUTOMATA THEORY

(Common to CSE, IT, ECM, ITE, CSE(CS))

Time: 3 Hours

Max. Marks: 75

**Note:** i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART – A****(25 Marks)**

- 1.a) What is a string? Write about concatenation of two strings. [2]
- b) What is a Regular expression in the theory of Automata? [3]
- c) Eliminate Useless symbols from the given grammar  
 $A \rightarrow xyz \mid Xyzz \quad X \rightarrow Xz \mid xYz \quad Y \rightarrow yYy \mid Xz \quad Z \rightarrow Zy \mid z$  [2]
- d) Write the design strategy for NFA-s. [3]
- e) Write any two properties of Regular languages. [2]
- f) Write about Leftmost derivation and rightmost derivation with example. [3]
- g) Define GNF. [2]
- h) Write the advantages of parse tree in identifying ambiguity. [3]
- i) What do you mean by Instantaneous Description of Turing Machine? [2]
- j) What is offline Turing Machine? [3]

**PART – B****(50 Marks)**

- 2.a) Define Finite Automaton. Explain about the model of Finite Automaton.
  - b) Convert the regular expression  $((00)^*(11) + 01)^*$  into an NFA. [5+5]
- OR**
- 3.a) Describe in brief about applications of Finite Automata.
  - b) Design a mealy machine to print out 1's complement of an input bit string. [5+5]
- 4.a) Write the steps to construct regular expression from given DFA.
  - b) Construct a NFA equivalent to the regular expression  $10(0+11)0^*1$ . [5+5]
- OR**
- 5.a) Write in brief about the algebraic rules for regular expressions.
  - b) Discuss in brief about applications of pumping lemma. [5+5]
- 6.a) Define Push Down Automata. Explain the basic structure of PDA with a neat graphical representation.
  - b) Construct a PDA that accepts  $L = \{0^n 1^n \mid n \geq 0\}$ . [5+5]
- OR**
- 7.a) Construct a PDA which accepts language of word over alphabet  $\{a,b\}$  containing  $\{a^i b^j c^k \mid i,j,k \in \mathbb{N}, i+k=j\}$ .
  - b) Define Context Free Grammar. State and explain the closure properties of CFG. [5+5]

8.a) Obtain Griebach Normal Form (GNF) for:  $S \rightarrow AB$ ,  $A \rightarrow BS/b$ ,  $B \rightarrow SA/a$ .

b) Define Ambiguous Grammar? Check whether the grammar

$S \rightarrow aAB$ ,  $A \rightarrow bC/cd$ ,  $C \rightarrow cd$ ,  $B \rightarrow c/d$

Is Ambiguous or not?

[5+5]

**OR**

9.a) Construct a Left most Derivation for the string 0011000 using the grammar

$S \rightarrow A0S/0/SS$ ,  $A \rightarrow S1A/10$  ?

b) Discuss in brief about decision properties of Context free languages.

[5+5]

10.a) Construct Turing machine for the languages containing the set of all strings of balanced parenthesis

b) Design Turing machine and its transition diagram to accept the language:

[5+5]

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

**OR**

11.a) Define LR(0) Grammar. Explain in detail about Post Correspondence Problem.

b) What is decidability? Explain in brief about any two undecidable problems.

[5+5]

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used papers 2023