Code No: 156EM **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, July - 2023
AUTOMATA THEORY AND COMPILER DESIGN
(Common to CSBS, CSIT, CE(SE))

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)	Why study automata theory? Give one application.	[2]
b)	Is language the same as the problem? Justify your answer.	[3]
c)	What do you understand by the sentential forms?	[2]
d)	Show that the following grammar is ambiguous. S -> aSbS|bSaS|λ.	[3]
e)	What are the applications of the Turing machine?	[2]
f)	Differentiate between decidability and intractability.	[3]
g)	What is the role of the symbol table?	[2]
h)	Differentiate between compiler and interpreter.	[3]
i)	What do you understand by access links?	[2]
j)	Differentiate between synthesized and inherited attributes.	[3]

PART – B

(50 Marks)

2.a) Give DFA's accepting the set of all strings such that each block of five consecutive symbols contains at least two 0's over the alphabet {0, 1}.
b) Design Epsilon-NFA's for the set of strings that consist of either 01 repeated one or more times or 010 repeated one or more times. [5+5]

OR

3.a) Give DFA's accepting the set of all strings that, when interpreted in reverse as a binary integer, is divisible by 5 over the alphabet {0, 1}.
b) Given NFA to accept the set of strings of 0's and 1's such that there are two 0's separated by a number of positions that is a multiple of 4. Note that 0 is an allowable multiple of 4. [5+5]

4.a) Write regular expressions for the set of all strings with an equal number of 0's and 1's, such that no prefix has two more 0's than 1's, nor two more 1's than 0's.
b) Write the statement of the pumping lemma and discuss the possible applications. [5+5]

OR

5.a) Consider the grammar $S \rightarrow aS \mid aSbS \mid$ Epsilon. Show that the string *aab* has two parse trees, leftmost derivations and rightmost derivations. If the grammar is ambiguous, then find an unambiguous grammar for the same language.
b) Prove that the following is not a regular language. $L = \{0^n1^m2^n \mid n$ and m are arbitrary integers$\}$. [5+5]

6.a) Design a PDA to accept the following languages. The set of all strings of 0's and 1's with an equal number of 0's and 1's.

b) Design Turing machines for the language $L = \{a^n\ b^n\ c^n \mid n \geq 1\}$. [5+5]

OR

7.a) Show that if P is a PDA, then there is a PDA P_1 with only two stack symbols, such that $L(P_1) = L(P)$.

b) Explain the diagonalization language with a suitable example. [5+5]

8.a) Construct the canonical LR and LALR sets of items for the below grammar. Compute the GOTO function to these sets of items. Show the parsing table for this grammar. Is the grammar canonical LR? Is the grammar LALR?

S → S S + | S S * | a

b) Show that the following grammar is SLR(1) but not LL(1). [5+5]

S → S A | A

A → a

OR

9.a) Why separate tokens and lexemes? Why make the lexical analysis a separate phase? Explain.

b) Show that the following grammar is LL(1) but not SLR(1). [5+5]

S → AaAb | BbBa

A → Epsilon

B → Epsilon

10.a) Construct the DAG for the following basic block.

d := b × c

e := a + b

b := b × c

a := e - d

b) Explain various storage-allocation strategies with suitable examples. [5+5]

OR

11.a) Translate the arithmetic expression a × - (b + c) into a syntax tree, postfix notation and three-address code.

b) Construct a context-free grammar for Roman numerals. Construct a syntax-directed translation scheme that translates Roman numerals into integers. [5+5]

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