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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B. E. - Computer Science and Engineering

Semester End Examination; July / August - 2022

Theory of Computation

Time: 3 hrs *Max. Marks: 100*

Course Outcome's

The Students will be able to:

CO1: Design finite automata

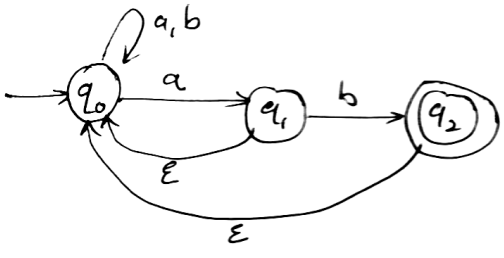
CO2: Apply regular expression for lexical analysis phases

CO3: Design grammars for various languages

CO4: Design push-down automata from grammars and grammar to PDA

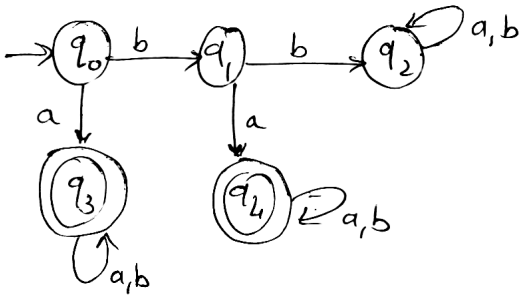
CO5: Design Turing machines for simple languages and design problem reductions to determine the undecidability of languages

Note: *i) **PART-A** is compulsory. One question from each unit for maximum of 2 marks.*
*ii) **PART-B**: Answer any **TWO** sub questions (from a, b, c) from each unit for a Maximum of 18 marks.*

Q. No.	Questions	Marks
	I : PART - A	**10**
I a.	What is the meaning of the following language $L = \{\hat{\delta}(q_0, w) = q_f\}$	2
b.	Name any two applications of regular expression.	2
c.	Recognize whether following grammar is ambiguous or not? Give reason. $S \rightarrow aS \mid aSbS \mid \varepsilon$	2
d.	What are the rules for PDA to be deterministic?	2
e.	When TM simulates compute, first and second tape represents what ?	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	Construct DFA's for the following language: $For\ \Sigma = \{a, b\}$ *i)* $L = \{w : \lvert w \rvert \bmod 3 \neq \lvert w \rvert \bmod 2\}$ *ii) all strings having at least two a's exactly one b*	9
b.	Determine DFA for the ϵ-NFA given in Fig.1(b),  Figure Q1(b)	9

Contd....2

c. Minimize the state of DFA given in Fig. 1(c) using table filling method.



9

UNIT - II **18**

2 a. Develop regular expression for the following:

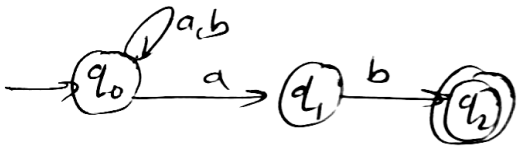
i) $L = \{w : |w| \bmod 3 = 0 \text{ where } w \varepsilon (a,b)^*\}$

ii) Words with 2 or more letters but beginning and ending with same letter for $\Sigma = \{a,b\}$

iii) $L = \{a^n b^m ; m+n \text{ is even}\}$

9

b. Convert given FA in Fig.2(b) to regular expression using kleen's theorem,



9

c. Inter the following language as not regular using appropriate theorem:

L={ 1^n|n is perfect square }

9

UNIT - III **18**

3 a. Construct LMD,RMD and parse tree for the grammar (string given is = aaabbabb)

$S \rightarrow aSb \mid S_1$

$S_1 \rightarrow aS_1a \mid bS_1b \mid \varepsilon$

9

b. Procedure CFG for the following language and derive appropriate string:

$L = \{a^i b^j c^k ; i = j \text{ or } j = k \text{ when } i, j, k \geq 0\}$

9

c. Convert following grammar into CNF:

$S \rightarrow ABC \mid BaB \mid$

$A \rightarrow aA \mid BaC \mid aaa$

$B \rightarrow bBb \mid a \mid \varepsilon$

$C \rightarrow CA \mid AC$

9

UNIT - IV **18**

4 a. Construct PDA for the following language $L = \{a^m b^n : m \neq n; m, n > 0\}$ 9

Contd....3

b. Produce PDA for the given language. 9

$L = \{w \mid num_w(a) > num_w(b)\}\ \Sigma = \{a, b\}$ .write the IDs for the string "aababa"

c. Produce a PDA for the following CFG

$P \rightarrow \varepsilon$

$P \rightarrow 0$

$P \rightarrow 1$ 9

$P \rightarrow 0P0$

$P \rightarrow 1P1$

Derive the string 1001 and write the ID's for same

UNIT - V **18**

5 a. Produce a turning machine for the language "ww^R", w$\epsilon\{0,1\}^+$. Write ID's for an appropriate string 9

b. Produce a turning machine to check balanced parentheses, $\sum=\{(,)\}$. Write ID's for an appropriate strings. 9

c. Demonstrate if this instance of PCP has a solution. Write short note on multi-tape TM

	List A	**List B**
1	abab	ababaaa
2	aaabbb	bb
3	aab	baab
4	ba	baa
5	ab	ba
6	aa	a

9

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