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10CS56

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Formal Languages and Automata Theory

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

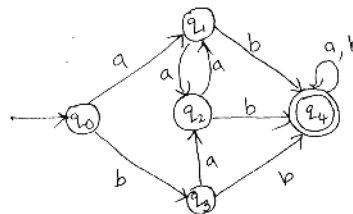
- 1 a. Define Finite automata. Write the application of finite automata. (05 Marks)
 b. Design a DFA to accept the following language over the alphabet {0, 1}.
 i) $L = \{(01)^i \cdot 2^j \mid i \geq 1, j \geq 1\}$
 ii) $L = \{\omega \mid |\omega| \bmod 3 = |\omega| \bmod 2\}$ (10 Marks)
 c. What is NFA? Explain with example. (05 Marks)

- 2 a. Define Regular expression. Find regular expression for the following languages.
 i) $L = \{a^n b^m \mid (m+n) \text{ is even}\}$
 ii) Strings of a's and b's whose 3rd symbol from right is a. (05 Marks)
 b. Consider the following ϵ -NFA

δ	ϵ	a	b	c
$\rightarrow p$	ϕ	p	q	r
q	p	q	r	ϕ
$*_r$	q	r	ϕ	p

- i) Compute ϵ -closure of each state (10 Marks)
 ii) Convert the automata to DFA (05 Marks)
 c. Obtain an ϵ -NFA for the regular expression $a^* + b^* + c^*$ (05 Marks)
- 3 a. If L and M are regular languages prove that $L \cap M$ is also regular. (05 Marks)
 b. Prove that the following language is not regular
 $L = \{0^n \mid n \text{ is prime}\}$ (05 Marks)
 c. Minimize the following DFA. (10 Marks)

Fig Q3(c)



- 4 a. Define CFG. Write CFG for the language.
 $L = \{0^n 1^n \mid n \geq 1\}$ (06 Marks)
 b. Consider the grammar
 $E \rightarrow +EE \mid *EE \mid -EE \mid x \mid y$
 Find leftmost and rightmost derivation for the string $+*xyxy$ and write parse tree. (08 Marks)
 c. Write the application of CFG. (06 Marks)

PART – B

- 5 a. Design PDA for the language $L = \{\omega \mid \omega \in (a+b)^* \text{ \& } n_a(\omega) = n_b(\omega)\}$ show that ID's for the string abbbbaa and also write the transition diagram. (12 Marks)
- b. Convert the CFG to PDA by empty stack.
 $I \rightarrow a \mid b \mid Ia \mid Ib \mid I0 \mid I1$
 $E \rightarrow I \mid E * E \mid E + E \mid (E)$ (08 Marks)
- 6 a. Eliminate ϵ , unit and useless production from the following grammar and put the resulting grammar into CNF. (12 Marks)
 $S \rightarrow ABC \mid BaB$
 $A \rightarrow aA \mid BaC \mid aaa$
 $B \rightarrow bBb \mid aD$
 $C \rightarrow CA \mid AC$
 $D \rightarrow \epsilon$
- b. State and prove pumping lemma for CFG. (08 Marks)
- 7 a. With a neat diagram, explain the working of basic Turing machine (08 Marks)
- b. Design TM to accept the language
 $L = \{0^n 1^n \mid n \geq 1\}$ (12 Marks)
- 8 Write short notes on :
a. Multitape Turing machine (05 Marks)
b. Halting problem in TM (05 Marks)
c. Post correspondence problem (05 Marks)
d. Recursive languages. (05 Marks)

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