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10CS56

Fifth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Formal Languages & 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. What is Automata? Discuss why study automata. (06 Marks)
 - b. Mention the differences between DFA, NFA and NFA-ε. (04 Marks)
 - c. Design a DFA to accept the language $L = \{W / W \text{ is of even length and begins with } 01\}$. (06 Marks)
 - d. Design the NFA-ε or NFA for the languages given below:
 - i) abc, abd and $aacd$ {Assume $\Sigma = a, b, c, d$ }
 - ii) $\{ab, abc\}^*$ {Assume $\Sigma = a, b, c$ }

2. a. Convert the following NFA-ε to DFA using "Subset construction scheme". (08 Marks)

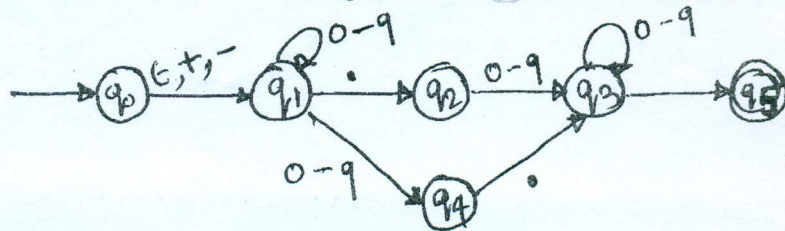


Fig. Q2 (a)

- b. Define Regular expression and write regular expression for the following languages:
 - i) $L = \{a^{2n}b^{2m} : n \geq 0, m \geq 0\}$
 - ii) Language over $\{0, 1\}$ having all strings not containing 00. (06 Marks)
 - c. Convert the regular expression $(0+1)^*1(0+1)$ to a NFA-ε. (06 Marks)
3. a. State and prove pumping Lemma theorem for regular languages. Show that $L = \{a^n b^n \mid n \geq 0\}$ is not regular. (08 Marks)
 - b. What is Homomorphism? Explain with an example. (04 Marks)
 - c. Consider the transition table of DFA given below:

	0	1
→A	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

Fig. Q3 (c)

- i) Draw the table of distinguishabilities of states.
- ii) Construct the equivalent minimized DFA. (08 Marks)

Important Note : 1. On completing your answers, carefully draw diagonal cross lines on the remaining blank spaces. 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



- 4 a. Obtain a grammar to generate integers and write derivation for the unsigned integer 1965. (08 Marks)
- b. Consider the grammar:
 $S \rightarrow aS \mid aSbS \mid \epsilon$
Is the above grammar ambiguous? Show that the string aab has two –
 - i) Parse trees
 - ii) Left most derivations
 - iii) Rightmost derivations(12 Marks)

PART – B

- 5 a. Define PDA. Design PDA to accept the language $L(M) = \{\omega C \omega^R \mid \omega \in (a+b)^*\}$ by a final state and also give the graphical representation of PDA. (12 Marks)
- b. Convert the following CFG to PDA:
 $S \rightarrow aABB \mid aAA$
 $A \rightarrow aBB \mid a$
 $B \rightarrow bBB \mid A$
 $C \rightarrow a$ (08 Marks)
- 6 a. Consider the following grammar:
 $S \rightarrow ASB \mid \epsilon$
 $A \rightarrow aAS \mid a$
 $B \rightarrow SbS \mid A \mid bb$
 - i) Are there any useless symbols? Eliminate if so.
 - ii) Eliminate ϵ productions.
 - iii) Eliminate unit productions.
 - iv) Put the grammar into Chomsky Normal Form. (08 Marks)
- b. Show that $L = \{a^n b^n c^n \mid n \geq 0\}$ is not context free. (04 Marks)
- c. Prove that the context free languages are closed under union, concatenation and reversal. (08 Marks)
- 7 a. Design a turing machine that performs the following function:
 $q_0 \omega \mid - * q_f \omega \omega$ for any $\omega \in \{1\}^*$
and also write its transition diagram. (12 Marks)
- b. Explain the general structure of multitape and non deterministic turing machines. (08 Marks)
- 8 Write short notes on:
 - a. Applications of regular expressions.
 - b. Applications of context free Grammars.
 - c. Post's correspondence problem.
 - d. Chomsky hierarchy. (20 Marks)
