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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-$\in$. **(04 Marks)**

c. Design a DFA to accept the language L = {W / W is of even length and begins with 01}. **(06 Marks)**

d. Design the NFA-$\in$ or NFA for the languages given below:

i) abc, abd and aacd {Assume $\sum = a, b, c, d$}

ii) {ab, abc}* {Assume $\sum = a, b, c$} **(04 Marks)**

2 a. Covert the following NFA-$\in$ to DFA using "Subset construction scheme". **(08 Marks)**

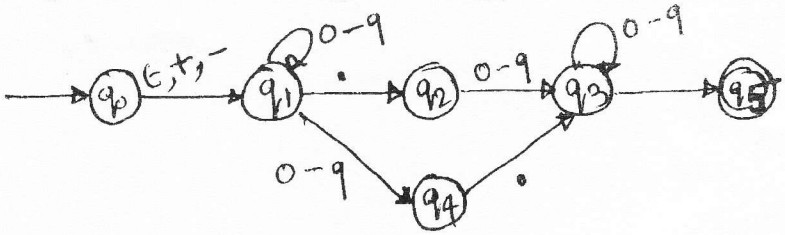

Fig. Q2 (a)

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-$\in$. **(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)**

4 a. Obtain a grammar to generate integers and write derivation for the unsigned integer 1965. **(08 Marks)**

b. Consider the grammar:
$S \rightarrow aS \mid aSbS \mid \in$
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:
$S \rightarrow ASB \mid \in$
$A \rightarrow aAS \mid a$
$B \rightarrow SbS \mid A \mid bb$
i) Are there any useless symbols? Eliminate if so.
ii) Eliminate $\in$ 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:
$q_0\omega \vdash {}^*q_f\omega\omega$ 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)**

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