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MCA

(SEM-II) THEORY EXAMINATION 2018-19

INTRODUCTION TO AUTOMATA THEORY AND LANGUAGES

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x10 = 20**

a. Explain the application and limitation of finite automata.

b. What is MyHillNerode theorem? Explain.

c. Define the Chomsky hierarchy. ?

d. Define DFA. Design a DFA for a language over the alphabet (0,1) that accept String ending with 101.

e. Define and give the difference between Kleene's closure and positive closure?

f. Give the regular expression for the set of all string over (a,b) containing exactly three a's.

g. Is context free language closed under union? If yes, give example.

h. Define alphabet, string and language.

i. Remove useless production from the given production: S->AB/a, A->b.

j. Explain recursively enumerable language with example.

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. What is regular expression? Construct a regular expression for given state transition diagram as shown in fig.1

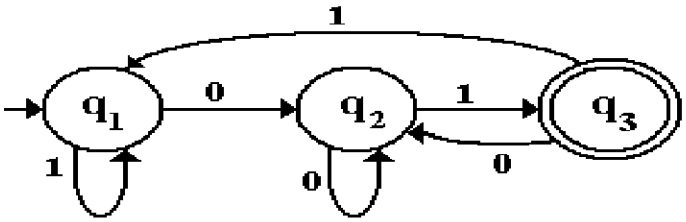

Fig .1

b. Reduce the grammar G=({S,A,B},{a,b),P,S) to the Chomsky normal form where production P is defined as:
S->bA/aB
A->bAA/aS/a
B->abb/bS/b

c. Prove that the language L={$a^n b^n c^n$/n>=0} is neither regular nor context free.

d. Construct the DFA equivalent to ε-NFA described by fig.2

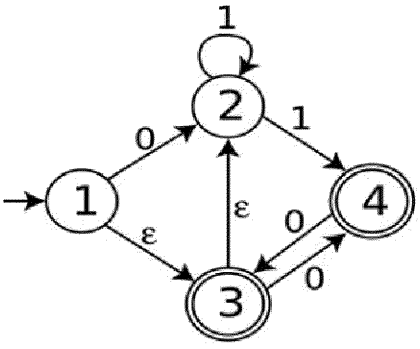

Fig.2

e. Describe the Mealy and Moore machines with example. Convert the given Mealy machine as shown in fig.3into Moore machine.

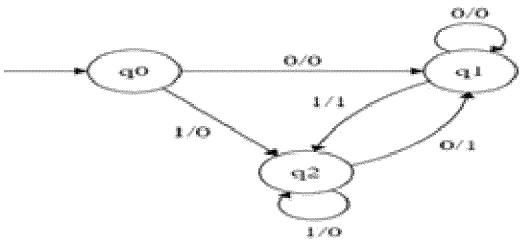

Fig 3

SECTION C

3. Attempt any *one* part of the following: 10 x 1= 10

(a) State Pumping Lemma for regular sets show that the set L= $\{a^p/p$ is prime$\}$ is not regular.

(b) Define a parse tree. Find the parse tree for the string bbaaaab consider the CFG:
S->XX
X-> XXX/bX/Xb/a
Is this ambiguous or not? justify

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain the Inherently Ambiguous context-free language with suitable language. Construct the context- free grammar that accept language L= $\{a^ib^jc^k/i=j$ or $j=k$; i,j,k are positive integer$\}$.

(b) What is Push down automata (PDA)?Design the PDA for the language L=$\{wcw^R/w\varepsilon\{a,b\}^*\}$

5. Attempt any *one* part of the following: 10 x 1= 10

(a) Define Turing machine(TM).Design a Turing machine which compute the following function: $f(w)=ww^R$, where w^R is the reverse of string w.($w\varepsilon\{a,b\}^*$)

(b) Construct a context free grammar G corresponding to following context free language, then construct PDA corresponding to G . L=$\{ 0^n1^{2n}/n>=1\}$.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Prove that $(1+00^*1) + (1+00^*1)(0+10^*1)(0+10^*1) = 0^*1(0+10^*1)^+$.

(b) Minimize following DFA shown in fig.4;

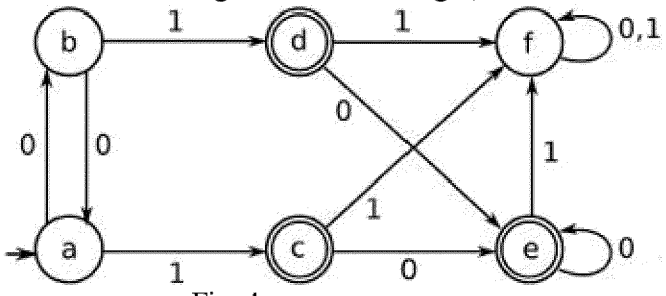

Fig. 4

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Write the short note of the following:
(i) Halting problem of Turing machine
(ii) Church's Thesis
(iii) Decidable and undecidable problem

(b) What are the Post's Correspondence Problem (PCP) and Modified PCP with application? Does the following PCP have a solution?
A=(101,100,10,0,010) B=(10,01,0,100,1).