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B. Tech.

(SEM IV) THEORY EXAMINATION 2017-18

THEORY OF AUTOMATA & FORMAL 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 x 10 = 20

a. Explain the applications and limitations of finite automata.

b. Explain what modifications will be required to transform a Finite Automata model into Turing machine.

c. What is MyHillNerode theorem? Explain.

d. What is extended transition functionδ*? Explain with example.

e. Give the difference between Mealy and Moore machine.

f. Define and give the difference between positive closure and Kleene closure.

g. What in nondeterministic PDA? Explain with the help of transition function.

h. Give the regular expression for set of all strings over {0,1} containing exactly three 0's.

i. Prove or disprove that union and concatenation of two context free languages is also context free.

j. Explain recursively enumerable languages with example.

SECTION B

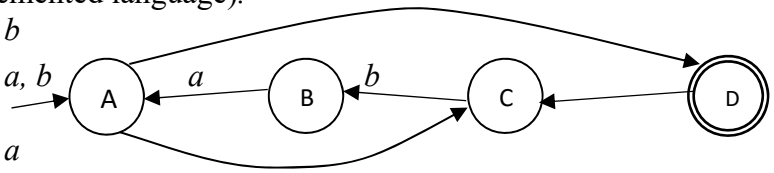
2. Attempt any *three* of the following: 10 x 3 = 30

a. Explain the purpose of following FA:

$\delta(q_1, a) = q_1, q_2, \quad \delta(q_1, b) = q_3, \quad \delta(q_2, a) = q_3, q_2$

$q_1$is initial state and $F = \{q_2, q_3\}$

b. Let the languageof FA given below be L. Determine the FA accepting L (*i.e.* Complemented language).



c. Prove that for all sets (i) $(S^+)^+ = S^+$, (ii) $(S^+)^* = S^*$

d. Prove that the language $L = \{a^n b^n c^n | n \geq 0\}$ is neither regular nor context free.

e. Explain Church's Thesis and prove that Halting problem of Turing machine is undecidable.

SECTION C

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

(a) Give finite automata for:

i) $L = \{a^n b^{2m} c^{3l} \mid n, m, l \geq 0\}$.

ii) $L = \{a^n b^{2m} \mid 0 < n < 3, \ m \geq 0\}$.

(b) Design DFA to accept all string over {0, 1} not ending with 10.

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

(a) Determine the language generated by grammar

$S \rightarrow Sab \mid aSb \mid abS \mid baS \mid bSa \mid Sba \mid aS \mid a$

(b) What is inherent ambiguity? Explain with the help of suitable example.

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

(a) Determine the grammar for language L = $\{a^n b^m \mid n \geq m\}$. Also explain the type of this language.

(b) Construct context free grammar G corresponding to following context free language, then construct PDA corresponding to G

$L = \{0^n 1^{2n} \mid n \geq 1\}$

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

(a) Design PDA for language:

$L = \{s \in (0, 1)^* \mid$ number of 0's and 1's are not equal in every string of $s\}$.

(b) Construct a Turing machine to accept the language $L = \{a^n b^n c^m \mid m, n \geq 0\}$.

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

(a) Explain variations in Turing machine to make it more capable. How Universal Turing machine can be considered as model of digital computer?

(b) Explain Modified Post Corresponding Problem. Does the following Post Corresponding Problem have a solution?

A= (101, 100, 10, 0, 010), B = (10, 01, 0, 100, 1)