SVKM's NMIMS

MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING

Programme: B. Tech (Computer) Year: III Semester: V

Academic Year: 2015-2016

Subject: Theoretical Computer Science

Date: 25/11/2015 Marks : 60
Time : 2.00 pm to 5.00 pm
Durations : 3 (hrs)

Final-Examination

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the answer book, which is provided for their use.

NB:

1. Question No.1 is compulsory.
2. Out of the remaining questions, attempt any 4 question.
3. In all 5 questions to be attempted.
4. All question carry equal marks.
5. Figures in brackets on the right hand side indicate full marks

1. a. Match the Languages in Group I with the corresponding Grammar in Group II and Automata in Group III [2]

Group II	Group I	Group III
Type 2	Context Sensitive	Turing Machine
Type 1	Recursive Enumerable	Finite State Automata
Type 0	Regular	Linear Bounded Machine
Type 3	Context Free	Push Down Automata

b. What is Post Correspondence Problem (PCP)? Determine whether the following list (A,B) have a PCP solution or not. If yes give solution. If no why? [4]

	A	B
i	w_i	x_i
1	001	01
2	0011	111
3	11	111
4	101	010

c. Convert following Regular Expression into equivalent English statement. [2]
   i. $(10+111)0^*1$
   ii. $(a+b)^*ba$
   iii. $(a+b)^*abb(a+b)^*$
   iv. $(0*1*)*$

d. What is Theoretical Computer Science? Explain its application in Compiler Construction. [4]

2. a. What is Chomsky Normal Form (CNF)? Convert following grammar to CNF. [6]
   $S \rightarrow ABA$
   $A \rightarrow aA|\varepsilon$
   $B \rightarrow bB|\varepsilon$

b. ~~What is Thompson's Rule? Give its Steps and~~ Convert Following Regular Expression to ~~NFA~~ epsilon (ϵ) NFA and then convert ϵ NFA to DFA. [6]

$(a+b)^*b(a+bb)^*$

3. a. Construct pictorial Post Machine that accepts the following language. [6]

$L=\{a^nb^na^n|n\geq 0\}$

b. Check whether or not following grammar is ambiguous. If it is ambiguous then remove the ambiguity and write an equivalent unambiguous grammar. [6]
S→iCtS | iCtSeS |a
C→b

4. a. Design Turing Machine for the function f(x,y) which evaluates the proper subtraction. [6]
$f(x,y) = x-y$ if $x \geq y$
$= 0$ if $x < y$

b. What is PDA? Give pictorial representation of PDA element and Construct PDA that accepts following language [6]
$L=\{a^n b^n \mid n\geq 0\}$

5. a. ~~Prove that every non-trivial property of an RE language is undecidable.~~ [4]
What is recursively Enumerable language. What are the properties of Recursively Enumerable language? prove any 2 proper one

b. Give mealy and Moore machine for input from $\Sigma=\{0,1\}$, if the input ends in 101 output should be A, if input ends with 110, output should be B, otherwise output should be C. [8]

6. a. Describe Linear Bounded Automata. [4]

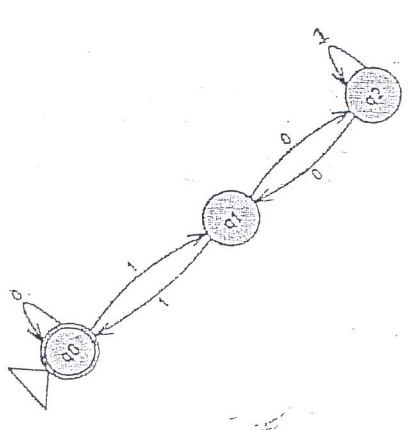
b. Explain following terms in relation with Turing Machine [4]
i. Solvability
ii. Semi-Solvability
iii. Unsolvability

c. Construct a Regular Expression corresponding to the following transition table of DFA. Apply Arden's theorem wherever appropriate. [4]

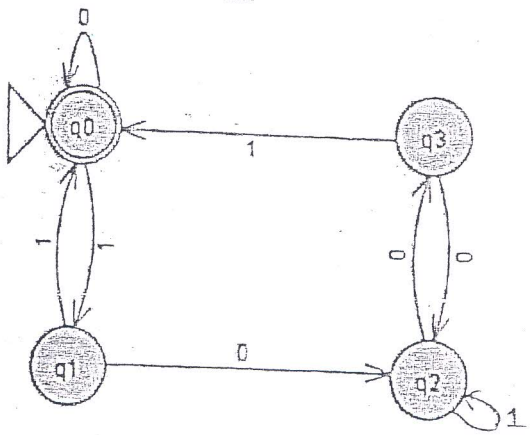
δ / Σ, Q	0	1
→q_0 +	q_0	q_1
q_1	q_2	q_1
q_2 +	q_0	q_1

7. a. Consider following two DFA M1 and M2 over {0, 1}. Determine whether M and M' are equivalent. [4]

M



M'



b. What is Chomsky Hierarchy? Explain with example. [4]

c. Explain Pumping lemma for Regular Set and show that [4]
$L=\{a^n b^n c^n \mid n\geq 1\}$ is not regular