Code No: RR310504 **Set No.1**

III B.Tech. I Semester Regular Examinations, November -2005
THEORY OF COMPUTATION
(Common to Computer Science & Engineering and Computer Science & Systems Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. For the following state transition table draw the state transition diagram. Find its equivalent machine. For the string abbaaab test whether both give same result or not. q_0 is the initial state and q_3 is the final state.

q / Σ	0	1
q_0	q_1	q_2
q_1	q_1	q_1 q_3
q_2	ϕ	ϕ
q_3	q_0 q_3	q_3

[16]

2. (a) Construct the Moore machine for Figure 1 Melay machine.

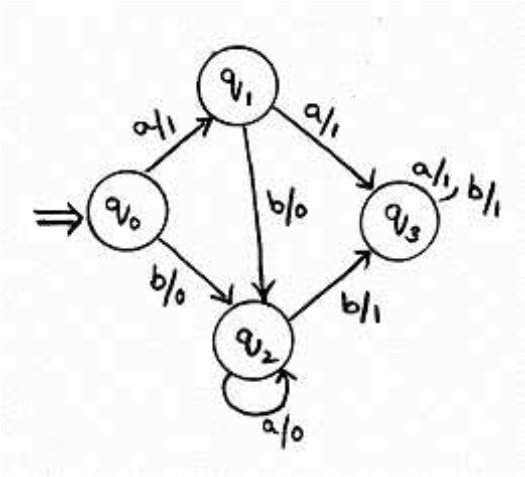

Figure 1:

(b) Minimise the Finite automation Figure 2 below and show both the given and the reduced one are equivalent.

[6+10]

3. (a) Construct a DFA for the regular expression 10 + (0+11) 0*1 and optimize the states.

(b) State and explain closure properties of regular sets.

(c) Show that the set $\left\{a^{i^2}/i \geq 1\right\}$ is not regular. State and explain the theorem used. [4+4+8]

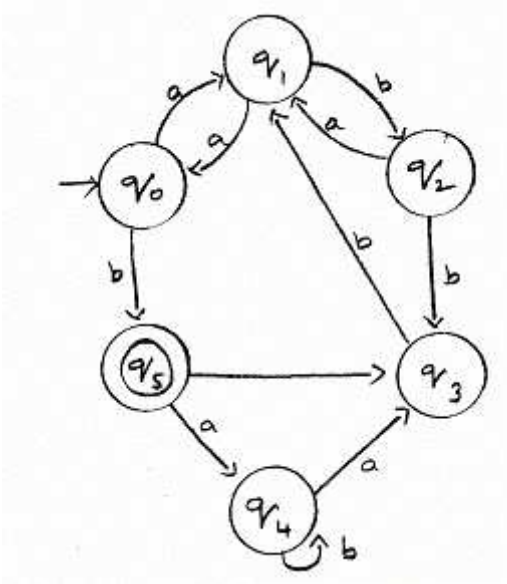

Figure 2:

4. (a) Obtain the regular grammar to accept the strings containing even number of zeroes.
   (b) Give the CFG to generating the following sets
   The set of palindromes over alphabet $\{a, b\}$ [8+8]

5. (a) Design a PDA which accepts all strings which can be derived from the following Grammar. Taking a suitable example verify the machine.
   S → aB/bA
   A → a/aS/bAA
   B → b/bS/aBB
   (b) Prove that acceptance by empty stack and by final state is equivalent. [8+8]

6. (a) What is delta of a Turing Machine, explain functions involved in a move of Turing Machines in detail.
   (b) Design Turing Machine to accept even palindromes derived from the input {a, b}. Give its Transition table and diagram also. [6+10]

7. Write short notes on:
   (a) DCFL and DPDA
   (b) LR(k) grammar
   (c) C.S. languages. [6+6+4]

8. (a) What is decidability? Explain any two undecidable problems.
   (b) Show that the following post correspondence problem has a solution and give the solution. [8+8]

	List A	List B
i	w_i	x_i
1	11	111
2	100	001
3	111	11

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Code No: RR310504 **Set No.2**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Give DFA which reads strings from $\{a, b\}$ and end with aaa.
   (b) Construct a DFA equivalent to M = $\{\{q_0, q_1\},\{0, 1\}, \delta, q_0, \{q_0\}\}$. δ is given by the state table.

State/Σ	0	1
q_0	q_0	q_1
q_1	q_1	q_0,q_1

[6+10]

2. (a) Construct the Moore machine for given Melay machine.

State / I	a	B	Output
q_0	q_1	Q_2	1
q_1	q_1	Q_1	0
q_2	q_1	q_0	1

   (b) Minimise the Finite automation given below and show both the given and the reduced one are equivalent.

State / Σ	a	b
q_0	q_0	q_3
q_1	q_2	q_5
q_2	q_3	q_4
q_3	q_0	q_5
q_4	q_0	q_6
q_5	q_1	q_4
q_6	q_1	q_3

[6+10]

3. (a) Construct FA equivalence to the following regular expression
   r = $((0 + 1(1 + 01)^*00)^*$
   (b) Give the regular expressions accepted by following FA. Figure 3 [8+8]

4. (a) Construct left linear and right linear grammar for the regular expression.
   0*(1(0+1))*
   (b) Give the CFG to generating the following sets
   The set of all strings over alphabet $\{a, b\}$ with exactly twice as many a's as b's. [8+8]

5. (a) Convert the following grammar into Chomsky Normal Form
   S → aA/a/B/C

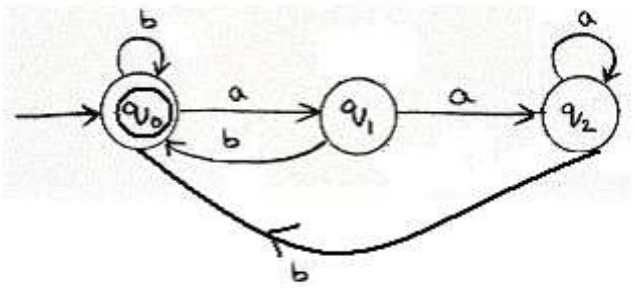

Figure 3:

A → aB/E
B → aA
C → cCD
D → abd

(b) Give CFG for generating sets of even palindromes over the string {a, b}.[8+8]

6. (a) What is the type of production to derive a recursive enumerable languages, which machine accepts these languages.

   (b) Giving the basic steps involved in designing a Turing Machine design a Turing Machine which accepts the strings derived form {0, 1} and have even number ones. [6+10]

7. Construct LR(0) items for the grammar given, find its equivalent DFA. Check the parsing by taking a suitable derived string. λ is null.
   $E \rightarrow T\,E'$
   $E' \rightarrow +T\,E' \mid \lambda$
   $T \rightarrow F\,T'$ [8+8]
   $T' \rightarrow *F\,T' \mid \lambda$
   $F \rightarrow i\,d$

8. Discuss any three of the following briefly.

   (a) Decidability of problems

   (b) Undecidability of post correspondence problem.

   (c) P and NP problems.

   (d) RICE's theorem. [16]

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Code No: RR310504 **Set No.3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. For the following state transition table draw the state transition diagram. Find its equivalent machine. For the string abbaaab test whether both give same result or not. q_0 is the initial state and q_3 is the final state.

q / Σ	0	1
q_0	q_1	q_2
q_1	q_1	q_1 q_3
q_2	ϕ	ϕ
q_3	q_0 q_3	q_3

[16]

2. (a) Define epsilon closure. Find epsilon closures for all the states of given NFA-E. Remove epsilons with out changing the acceptance. Figure 4

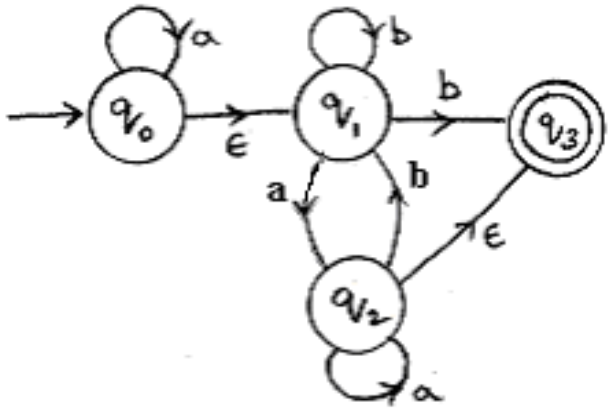

Figure 4:

(b) Construct Moore machine equivalent to the mealy machine described below.

q_i	a=0		a=1	
	q_1+1	output	q_i+1	Output
q_1	q_i	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	1	q_3	1
q_4	q_3	0	q_1	1

[8+8]

3. (a) Construct Finite automaton to accept the regular expression $(0+1)^*$ (00+11) $(0+1)^*$.
   (b) Find the regular expression accepted by following deterministic Finite automaton. Figure 5 [8+8]

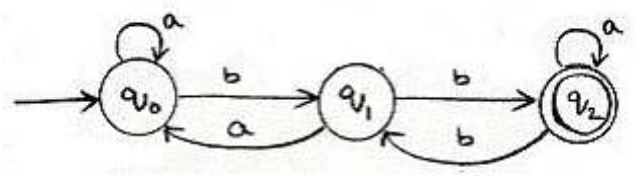

Figure 5:

4. (a) Construct finite automata recognizing the following regular grammar.
   $A_o \rightarrow aA_1$
   $A_1 \rightarrow bA_1/bA_o/a$
   (b) What is meant by ambiguous grammar? Test whether the grammar is ambiguous or not. $S \rightarrow A/B, A \rightarrow aAb/ab, B \rightarrow abB/\wedge$ [8+8]

5. Construct a context free Grammar which accepts N(A) and simplify the same.
   where A = ($\{q_0, q_1\}$, {a, b}, $\{z_0$, z$\}$, δ , q_0, z_0, ϕ)
   where δ is given by
   $\delta\ (q_0, \text{b}, z_0) = \{(q_0, zz_0)\}$
   $\delta\ (q_0, \in, z_0) = \{(q_0, \in)\}$
   $\delta\ (q_0, \text{b}, \text{z}) = \{(q_0, zz)\}$
   $\delta\ (q_0, \text{a}, \text{z}) = \{(q_1, z)\}$
   $\delta\ (q_1, \text{b}, \text{z}) = \{(q_1, \in)\}$
   $\delta\ (q_1, a, z_0) = \{(q_0, z_0)\}$ [16]

6. (a) Why the Languages accepted by Turing machine are called "recursively enumerable languages". Explain atleast two properties of r.e. languages.
   (b) Design Turing machine to find square of a given integer. [6+10]

7. Construct LR(0) items for the grammar given, find its equivalent DFA. Check the parsing by taking a suitable derived string.
   $S \rightarrow E$
   $E \rightarrow E + T \,|\, T$ [8+8]
   $T \rightarrow a \,|\, (E)$

8. (a) Explain Rice's theorem for undecidable problems.
   (b) List the problems that are decidable for DCFL's. [8+8]

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Code No: RR310504 **Set No.4**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. For the state transition table given find the state transition diagram. Check whether the string 00101011 is accepted or not. Determine equivalent DFA and check for the same string and prove both are equivalent. q_0 is the initial state and q_2 is the final state.

q / Σ	0	1
q_0	q_0, q_1	ϕ
q_1	ϕ	q_1, q_2
q_2	q_1	ϕ

[8+8]

2. For the NFA-E given check whether the string aannanan is accepted or not, If accepted write the transition path. Find equivalent NFA without epsilon transitions, explain the procedure used and check the string given on your new NFA. Figure 6 [16]

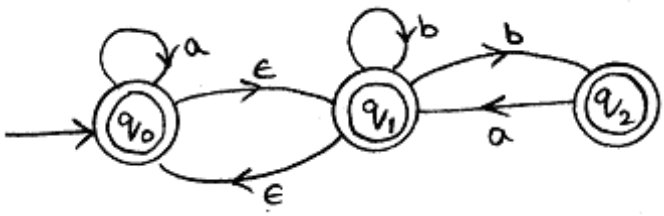

Figure 6:

3. (a) Describe the equivalence of finite automata and regular expressions.
   (b) Show that $\{0^n\ 1^m$ / gcd (n,m) = 1$\}$ is not regular.
   (c) Construct the regular expression accepted by the following finite automaton. Figure 7 [4+6+6]

4. (a) Obtain the regular grammar to accept the strings containing even number of zeroes.
   (b) Give the CFG to generating the following sets
   The set of palindromes over alphabet $\{a, b\}$ [8+8]

5. (a) Convert the following grammar to Chomsky Normal form
   S $\rightarrow \sim$ S /[S $\supset$S] /p/q

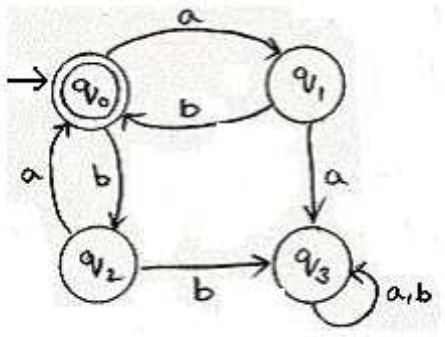

Figure 7:

(b) Obtain the PDA to accept the language
L={w/w∈ (a,b)* and n_a(w)>n_b(w)<n_b(w)} [8+8]

6. (a) Give formal definition of Turing Machine and explain the concept behind saying "Turing Machine is more powerful than the digital computer".

(b) Design Turing Machines for the following:

i. To compliment a given binary number.

ii. To compute f(x,y) = x+y for x and y positive integers represented in Unary. [4+12]

7. (a) Discuss the Chomsky Hierarchy of languages.

(b) For the grammar shown below construct the sets of LR(0) items.
$S' \rightarrow S\,\$$
$S \rightarrow a\,S\,b \mid a\,b$ [6+10]

8. Write short notes on

(a) Universal Turing machine

(b) NP hard and NP complete problems. [8+8]

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