Exam.Code:0917
Sub. Code: 33437

2125

B.E. (Computer Science and Engineering)
Fifth Semester
CS-504: Theory of Computation

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Section.

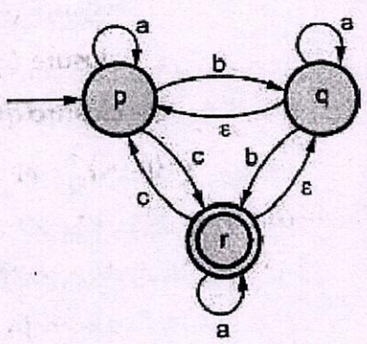
x-x-x

1. Answer the following:
   a) Differentiate between Mealy and Moore machines.
   b) Construct a DFA accepting the language over the alphabet {0, 1} that has the set of all strings ending in '00'.
   c) What is kleen's closure? Find a(a)*.
   d) Show that the grammar $S \rightarrow SbS|a$ is ambiguous.
   e) Give the formal definition of acceptance by PDA.
   f) Explain Instantaneous description of Turing Machine by taking its snapshot.
   g) Find the derivation tree for a grammar, G: S→*0B|1A, A* →0|0S |*1AA, B* →1|1S|*0BB* for the string 00110101.
   h) Describe Multi-tape Turing machine.
   i) Define NP and P classes.
   j) Let G be S →AB, A →a, B →C|b, C →D, D →E and E →a. Eliminate unit productions and get an equivalent grammar.

(10x1=10)

<u>Section A:</u>

2. a) Construct a deterministic finite automaton which is equivalent to nondeterministic finite automata with ε-moves whose transition diagram is given below.



   b) Consider the transition table given below. Prove that the strings recognized are $(a+ b (b + abb)^* (aa + aba))^* (b(b + abb)^* ab)$.

Q \ Σ	a	b
→q_1	$\{q_1\}$	$\{q_2\}$
q_2	$\{q_3\}$	$\{q_2\}$
q_3	$\{q_1\}$	$\{q_4\}$
((q_4))	$\{q_1\}$	$\{q_2\}$

(06+04)

3. a) Construct the reduced grammar equivalent to the grammar G = ({U, V, W, X, Y,}, {0, 1}, P, U), where the set of productions P is given as follows:
   U→0V0
   V→U1|1WW|Y0V
   W→011|YY
   X→0W
   Y→0YV

P.T.O.

b) Convert the grammar G = ({X, Y, Z}, {0, 1}, P, X), into Greibach normal form, where the set of productions P is given as follows:
X → Y Z
Y → Z X|1
Z → X Y|0

(04+06)

4. a) Find a regular expression that represents all binary strings over {0,1} containing an even number of 1s. Convert the regular expression into nondeterministic finite automata with ε-moves and then into the corresponding deterministic finite automata.

b) Define distinguishable and indistinguishable states. Construct a minimum state Automaton equivalent to a DFA whose transition table is given below. Draw the transition diagram of resulting DFA.

Σ / Q	0	1
→q_0	q_1	q_4
q_1	q_2	q_5
(q_2)	q_3	q_7
q_3	q_4	q_7
q_4	q_5	q_8
(q_5)	q_6	q_1
q_6	q_7	q_1
q_7	q_8	q_2
(q_8)	q_0	q_4

(04+06)

Section B:

5. a) Construct pushdown automata for accepting the language L = $\{WW^R \mid W \text{ in } (0+1)^*\}$.

b) Construct a CFG which accepts N(A) where A = ({q_0,q_1}, {a,b}, {Z_0,Z}, δ, q_0, Z_0, ∅}. δ is given by:

$$\delta(q_0, b, Z_0) = \{(q_0, ZZ_0)\}$$
$$\delta(q_0, \wedge, Z_0) = \{(q_0, \wedge)\}$$
$$\delta(q_0, b, Z) = \{(q_0, ZZ)\}$$
$$\delta(q_0, a, Z) = \{(q_1, Z)\}$$
$$\delta(q_1, b, Z) = \{(q_1, \wedge)\}$$
$$\delta(q_1, a, Z_0) = \{(q_0, Z_0)\}$$

(05+05)

6. a) Discuss in detail the halting problem and its consequences.

b) Design a Turing machine that can accept the set of all even palindromes over {0, 1}. Draw its transition diagram also. Compute the sequence of execution by taking suitable string of given language.

(03+07)

7. a) Discus in detail Tractable and Intractable problems.

b) Explain why one should study undecidability?

c) Let f be the function $f(n) = n - 1$ when $n > 0$ and $f(0) = 0$. Show that f is computable.

(03+03+04)

x-x-x