[3863] – 445

T.E. (Computer) (Semester – I) Examination, 2010
THEORY OF COMPUTATION
(2008 Course) (New)

Time: 3 Hours Max. Marks: 100

Instructions : *1) Answer **three** quetions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** answer books.*
*3) **Neat** diagrams must be drawn **whenever** necessary.*
*4) Figures to the **right** indicate **full** marks.*
*5) Assume suitable data, **if necessary**.*

SECTION – I

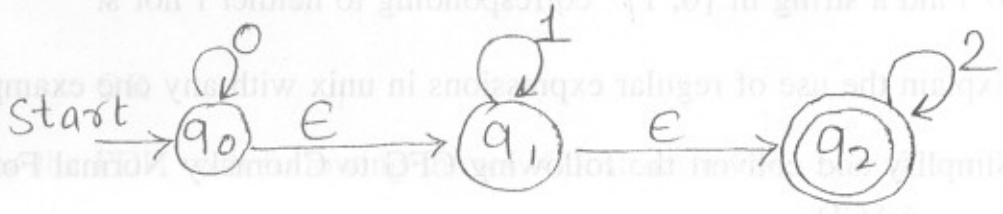
1. a) Define the following terms with example. **6**
   1) Symbol 2) Alphabet
   3) DFA

   b) Design a Mealy machine that accepts strings ending in '00' and '11'. Convert the Mealy machine to the equivalent Moore machine. **10**

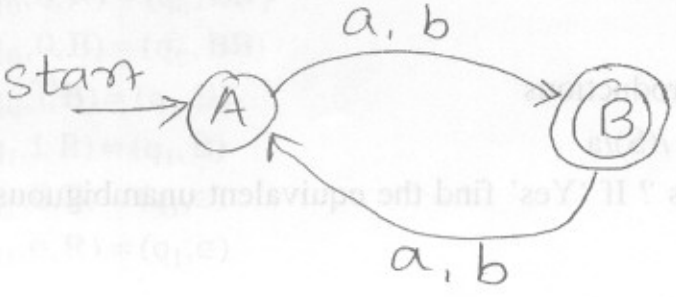
OR

2. a) Define the following terms with example. **6**
   1) Basic machine 2) Moore Machine
   3) Mealy machine

   b) Consider the following NFA with E-transitions. Convert this NFA to **10**
   1) NFA without ϵ -moves 2) DFA



3. a) Consider the following transition diagram. Convert it to the equivalent regular expression. **6**



P.T.O.

b) Find a regular expression corresponding to each of the following subsets of $\{0, 1\}^*$. **6**

1) The language of all strings containing exactly two 0's.

2) The language of all strings containing atleast two 0's.

3) The language of all strings not containing the substring 00.

c) Prove the formula. **4**

1) $\phi^* = \in$ 2) $(r^* s^*) = (r + s)^*$

OR

4. a) For the following regular expression, draw an FA recognizing the corresponding language. **6**

$r = (1+10)^* 0$

b) Consider the two regular expressions

$r = 0^* + 1^*$ $S = 01^* + 10^* + 1^*0 + (0^* 1)^*$

1) Find a string corresponding to s but not to r.

2) Find a string corresponding to both r and s.

3) Find a string in $\{0, 1\}^*$ corresponding to neither r nor s. **6**

c) Explain the use of regular expressions in unix with any one example. **4**

5. a) Simplify and convert the following CFG to Chomsky Normal Form. **12**

$S \rightarrow AACD$

$A \rightarrow aAb/\in$

$C \rightarrow aC/a$

$D \rightarrow aDa/bDb/\in$

b) Consider the CFG with productions

$S \rightarrow S + S/S - S/S^*S/S/S /(S)/a$

Is the grammar ambiguous ? If 'Yes' find the equivalent unambiguous grammar. **6**

OR

6. a) Decribe the language generated by each of these grammars. Justify your answer with an example. **12**

1) $S \rightarrow a\ S\ a \mid b\ S\ b \mid \in$

2) $S \rightarrow a\ S\ a \mid b\ S\ b \mid a \mid b$

3) $S \rightarrow a\ S\ b \mid b\ S\ a \mid \in$

4) $S \rightarrow SS \mid bS \mid a$

b) Convert the following grammar to Griebach Normal form. **6**

$S \rightarrow ABA|AB|BA|AA|A|B$

$A \rightarrow aA|a$

$B \rightarrow bB|\ b.$

SECTION – II

7. a) Construct pushdown automata for $L = \{ W\ C\ W^R / W \in (a + b)^* \}$ and W^R is reverse string of W. **6**

b) Construct pushdown automata for the given CFG with productions **6**

$S \rightarrow a\ AA$

$A \rightarrow bS|\ aS$

$S \rightarrow a$

c) Explain the equaivalence of PDA with acceptance by final state and empty stack. **6**

OR

8. a) Consider the PDA with following moves. Construct a CFG equivalent to PDA. **8**

$M = (\ \{q_0, q_1\}, \{0, 1\}, \{B, R\}, \delta, q_0, R, \phi\ )$

Where δ is defined as :

$\delta(q_0, 0, R) = (q_0, BR)$

$\delta(q_0, 0, B) = (q_0, BB)$

$\delta(q_0, 1, B) = (q_1, B)$

$\delta(q_1, 1, B) = (q_1, B)$

$\delta(q_1, 0, B) = (q_1, \in)$

$\delta(q_1, \in, R) = (q_1, \in)$

b) Construct a PDA equivalent to the following CFG 6

$S \rightarrow 0AA$

$A \rightarrow 0S/1S/0$

c) Explain how DPDA is different from NPDA. 4

9. a) Construct a turing machine for reversing a string. 8

b) Design a Post machine for the language $L = \{0^n 1^{2n}\}$. 8

OR

10. a) Construct a turing machine for finding 2's complement of a binary number. 8

b) Explain the following terms in relation with turing machine. 8

1) Solvability 2) Semi-solvability and

3) Unsolvability.

11. a) What is post correspondence problem ? Explain with example. 8

b) What is Halting problem ? Prove that halting problem is undecidable. 8

OR

12. a) Explain the following terms with example.

1) Computational complexity

2) P - class problems

3) NP- class problems

4) Modified PCP problem. 8

b) Define the following terms

1) Recursive language

2) Recursively enumerable language

3) Intractable problems

4) Universal turing machine. 8
