322554(22)

B. E. (Fifth Semester) Examination, April-May 2021

(New Scheme)

(CSE Engg. Branch)

THEORY OF COMPUTATION

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *All questions are compulsory. Part (a) is compulsory, answer any two parts from (b), (c) & (d) of each question. Part (a) carries 2 marks and part (b), (c) & (d) carries 7 marks.*

Unit-I

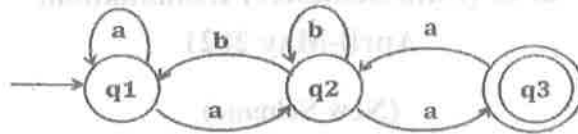1. (a) Construct NFA that accepts the set of all strings over {0, 1} that :
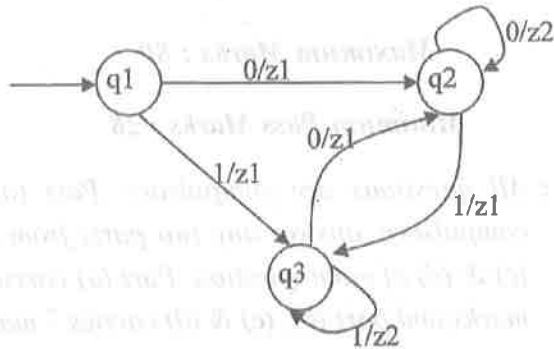
    (i) Begins either with 0 or 1

(ii) Contains the substring 00

(b) Consider the transition system and prove that the strings recognized by it is
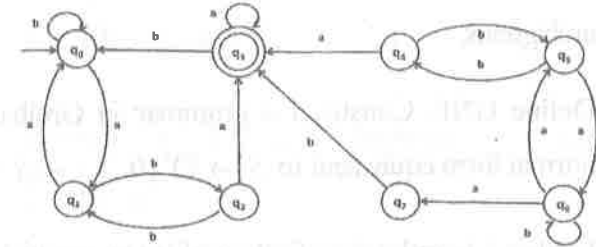
$$(a + a(b + aa)*b)*a(b + aa)*a$$

(c) Explain Moore and Mealy M/c. Construct Moore M/c which is equivalent to the Mealy M/c given in the diagram.

(d) Construct minimum state automation equivalent to transition diagram :

Unit-II

2. (a) Construct regular expressions for the following :

(i) Any string formed using $\{0, 1\}$ with 1 as the fourth symbol from the end.

(ii) First character 'a' or 'c' followed by any string in 'b'.

(b) Explain closure propeties of regular sets.

(c) List and prove any three decidable properties of regular sets.

(d) State and prove pumping lemma for regular sets.

Prove that $L = \{ww^r \mid w \text{ in } \{0,1\}*\}$ is not regular.

Unit-III

3. (a) Show that the grammar $G : S \rightarrow SbS \mid a$, is ambiguous.

   (b) Define GNF. Construct a grammar in Greibach normal form equivalent to $S \rightarrow YY \mid 0, Y \rightarrow SS \mid 1$.

   (c) Explain Chomsky classification of langauges giving example and discuss the relation between the classes of these language.

   (d) Remove unit productions and construct grammar in Chomsky normal form equivalent to grammar

   $S \rightarrow ABC \mid 0, A \rightarrow 1, B \rightarrow C \mid 0, C \rightarrow D, D \rightarrow E, E \rightarrow 2$

Unit-IV

4. (a) (i) A PDA can accept a CFL L.

         (a) By null store

         (b) by final state

         (c) both (i) and (ii)

         (d) None of the above

      (ii) What is the relationship between the class of languages accepted by DPDA and NPDA.

   (b) Design a PDA M to accept the language $L = \left\{ 0^n \ 1^{n+2} \mid n \geq 1 \right\}$.

   (c) Design a Turing Machine to accept $L = \left\{ a^n \ b^n \mid n \geq 1 \right\}$.

   (d) State and explain post correspondence problem. List its applications. Find the solution to the instance of PCP given in Table.

i	x_i	y_i
1	0	000
2	01000	01
3	01	1

Unit-V

5. (a) $U_2^4 \left(S(4), S(5), S(6), Z(7) \right)$ is :

      (i) 6

      (ii) 5

      (iii) 4

      (iv) 0

(b) (i) Prove that a function $f(n) = x/2$ is partial recursive function over N (natural) number.

(ii) Explain space and time complexity theory.

(c) Ackermann's function is defined by :

$$A(0, y) = y + 1$$

$$A(x+1, 0) = A(x, 1)$$

$$A(x+1, y+1) = A(x, A(x+1, y))$$

$A(x, y)$ can be computed for every (x, y) and hence $A(x, y)$ is total. Ackermann's function is not primitive but recursive. Compute

$$A(1,1), A(2,1), A(1,2), A(2,2).$$

(d) Write short notes on :

(i) Recursively enumerable languages

(ii) Church's Hypothesis