

N.B. : (1) Question No. 1 is compulsory.
(2) Attempt any four from question Nos. 2 to 7.

1. (a) Construct a DFA that accept the following language : 5
 $L = \{w \mid w \text{ has both an even number of 0's and an even number of 1's}\}$
- (b) Write a grammar for following language : 5
 $L_1 = \{0^n 1^n 2^i \mid n \geq 1, i \geq 1\}$ $L_2 = \{0^i 1^n 2^n \mid n \geq 1, i \geq 1\}$
- (c) Using pumping lemma, find out whether the language $L = \{w \in \{a, b\} \mid w = w^R\}$ is regular or not. 5
- (d) Compare and contrast Moore and Mealy machine. 5

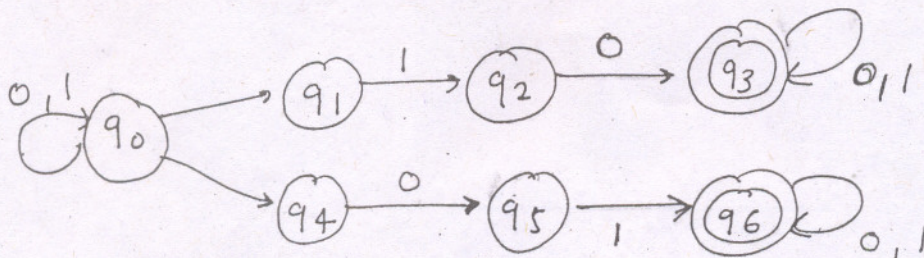
2. (a) Construct NPDA for the language $L = \{0^n, 1^{2n} \mid n \geq 0\}$ such that $L = L(M)$. 10
- (b) Consider the grammar G : 10
 $S \rightarrow a S b \mid a S \mid a$ that generates the language $\{a^m b^n \mid n < m\}$ Let $x = aab$ Construct a top-down parsing for x.

3. (a) Design a Turing machine that checks whether a string of left and right parenthesis is well formed or not. 12
 Assume that the input string consisting of left and right parenthesis is bounded by.
- (b) Explain post correspondence problem in detail. An instance of it consist of two list of strings. 8
 Find solution to this PCP :

	List X	List Y
i	x_i	y_i
1	101	1
2	01	10
3	1	01
4	11	111

4. (a) Eliminate useless symbols, useless production unit production and null production from the following grammar 10
 $S \rightarrow a S \mid A \mid C$
 $A \rightarrow a$
 $B \rightarrow aa$
 $C \rightarrow acb$
- (b) Generate and reduce the grammar for the following to CNF and GNF $a^n b^n$ 10

5. (a) Design a FSM machine for deciding whether a given decimal number as an input string is divisible by 4. 8
- (b) Convert following NFA to corresponding DFA : 12



6. (a) Using pumping lemma. Prove : 10
 (i) $a^n b^n c^n$ is not context free (ii) $L = \{a^n \mid n \text{ is prime}\}$ is not regular.
- (b) Construct a Turing Machine to subtract two numbers (e.g. m and n are two integers and $m - n$ is to be evaluated) assume $m > n$. 10

7. Write short notes on any **four** :-

- (a) NP- hard problem
- (b) Recursively enumerable language
- (c) Operator precedence parser
- (d) Chomsky Hierarchy
- (e) Closure of regular language.