

7. Explain the following :
- | | |
|-------------------------------------------|---|
| (i) Different variants of Turing Machine. | 8 |
| (ii) Halting problem is undecidable. | 6 |
| (iii) Linear Bounded Automata | 6 |

SECTION – D

8. (a) Show that the predecessor and factorial function is primitive recursive. 10
- (b) Write a detailed note on undecidable problems from language theory. 10
9. Write notes on :
- | | |
|-----------------------------------------------------------------------|---|
| (a) Tractable decision problems | 7 |
| (b) Recursion and successor function in Primitive recursive functions | 7 |
| (c) Church Turing Thesis | 6 |

Roll No.

22642

**M.Tech. 1st Semester (CSE) CBCS Scheme
Examination – February, 2022
MATHEMATICAL FOUNDATIONS OF COMPUTER
SCIENCE**

Paper : MTCSE21C5

Time : Three hours] [Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

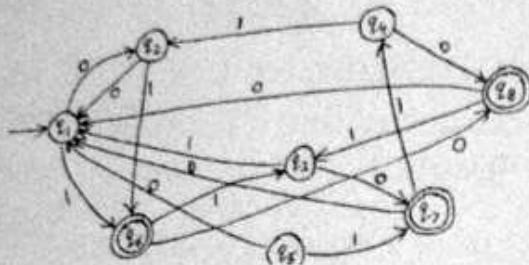
Note : Attempt *five* questions in all, selecting *one* question from each Section. Question 1 is *compulsory*. All questions carry equal marks.

1. (a) Design a transition diagram of PDA for language $L = \{ a^n b^{2n} \mid n \geq 1 \}$.
- (b) Design a transition diagram of DFA to accept strings ending with *aa*.
- (c) What is Normal form in CFG ? Explain the rule to write the productions in CNF and GNF.
- (d) Short note on Top Down Parsing.
- (e) Define the transition function of DTM and NDTM.
- (f) Explain Halting problem of TM.
- (g) Explain with example the composition function of primitive recursive function.
- (h) Define Reducibility. 2.5 × 8 = 20

SECTION - A

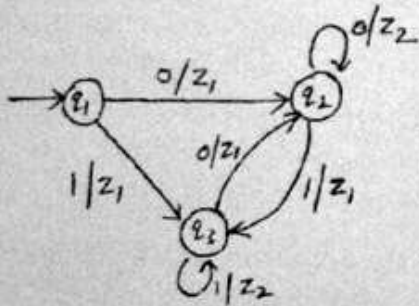
2. (a) Minimize the given Automata (by using equivalence method only i.e. π_0, π_1, π_2 method):

10



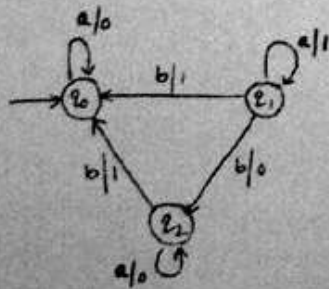
- (b) Convert the Mealy machine into the Moore Machine:

10



- (a) Convert the following Mealy Machine to Moore Machine by dividing the states into substates method:

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-(P-4)(Q-9)(22)

(2)

- (b) Design a DFA for the language contains strings in which left most symbol differ from right most symbol.

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SECTION - B

4. (a) Construct a PDA equivalent to the following CFL:

10

$$S \rightarrow aSa \mid bSb \mid C$$

Test whether $abbCbba$ is in $N(P)$.

- (b) Design a top-down parser for the expression $x + y * z$ for the grammar G with the following production rules:

10

$$S \rightarrow S + X \mid X$$

$$X \rightarrow X * Y \mid Y$$

$$Y \rightarrow (S) \mid id$$

5. (a) Construct a PDA for the language:

10

$$L = \{ a^m b^{m+n} a^n \mid m, n \geq 1 \}$$

- (b) Construct a PDA for the language:

10

$$L = \{ w C w^r \mid w \in \{a, b\}^* \}$$

SECTION - C

6. (a) Design a T. M. to perform multiplication. Draw only transition diagram.

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- (b) Design a Turing Machine to perform proper subtraction. Also perform the trace of machine.

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