

# **1. What is recursive enumerable and recursive set?**

Recursive Enumerable set:

The languages accepted by Turing Machines are called as recursive enumerable languages.

Recursively enumerable set includes regular languages and CFL's. some languages in recursive enumerable set are not accepted by TM.

Recursive set:

The subset of recursive enumerable set is called as recursive set. All the languages in the recursive set are accepted by TM.



### 5. What is universal turing machine?

Universal Turing machine:

If the problem is undecidable.

Does the turing machine  $M$  accept input  $w$ ? here both  $M$  and  $w$  are the parameters of the problem. In formalizing a problem as a language. The input  $w$  is restricted to be over  $\{0,1\}$  and  $M$  to have tape alphabet  $\{0,1,B\}$ . This Turing Machine is referred as Universal Turing Machine.



## 1. What is Turing machine?

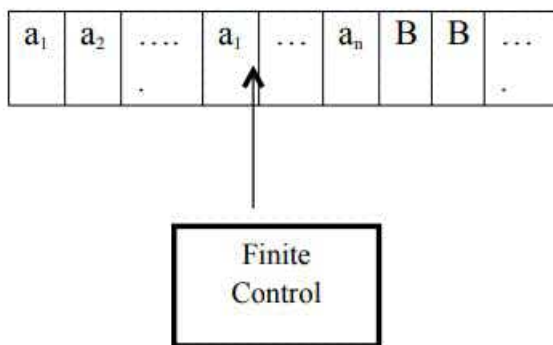
The basic modes of a TM has

- a) A finite control
- b) An infinite tape
- c) A tape head

\*An input tape is divided into cells. The tape is infinite to the right.

\*each cell of the tape holds exactly one symbol.

\*The tape head moves in both direction.



4

### 3. Define instantaneous description of turing machine?

ID of Turing machines is denoted by  $\alpha_1 q \alpha_2$ .

Where  $q \rightarrow$  is the current state of M

$\alpha_1, \alpha_2 \rightarrow$  is the string in



## **7.What are the techniques for Turing machine construction?**

Techniques for TM construction:

1. Storage in the finite control
2. Multiple tracks
3. Checking off symbols
4. Shifting over
5. Subroutines

3

## **8. What is multi head and multi tape turing machines?**

A multi tape turing machine consists of a finite control with  $k$  tape heads and  $k$  tapes.

Each type is infinite in both directions.

On a single move depending on the state and the scanned by each tape head, the Turing machine.

1. Changes state
2. Print a new symbol scanned by each tape head
3. Move each of its tape head independently one cell to the left or right.

b

### 5. Define Deterministic Push down Automata?

The PDA  $M = (Q, \Sigma, \Gamma, \delta, q_0, z_0, F)$  is deterministic if

i) for each  $q$  in  $Q$  and  $Z$  in  $\Gamma$ , whenever  $\delta(q, \epsilon, Z)$  is non empty then  $\delta(q, a, Z)$  is empty for all  $a$  in  $\Sigma$ .

ii) for no  $q$  in  $Q$   $Z$  in  $\Gamma$  and  $a$  in  $\Sigma \cup \{\epsilon\}$  does  $\delta(q, a, z)$  contain more than one element.

## 5. Define the language accepted by Turing Machine?

### The Language accepted by TM:

- ★ The language accepted by M, denoted  $L(M)$  is the set of words in  $\Sigma^*$  that cause M to enter a final state.
- ★ Formally the language accepted by TM.  
 $M = (Q, E, \Delta, q_0, B, F)$  is  
 $L(M) = \{w \mid w \text{ in } \Sigma^* \text{ and } q_0 \vdash w \vdash P \text{ for some } P \text{ in } F \text{ and } \alpha_1 \text{ and } \alpha_2\}$
- ★ The TM halts, (e) has no next move, whenever the input is accepted.
- ★ The TM will never halt for the words which are not accepted.



## 12. What are NP problems?

The problems that can be solved in a non-deterministic polynomial time by non deterministic turing machine.

Example: Undecidable problem

## 13. What is NP complete problems?

9