Assignment - 6

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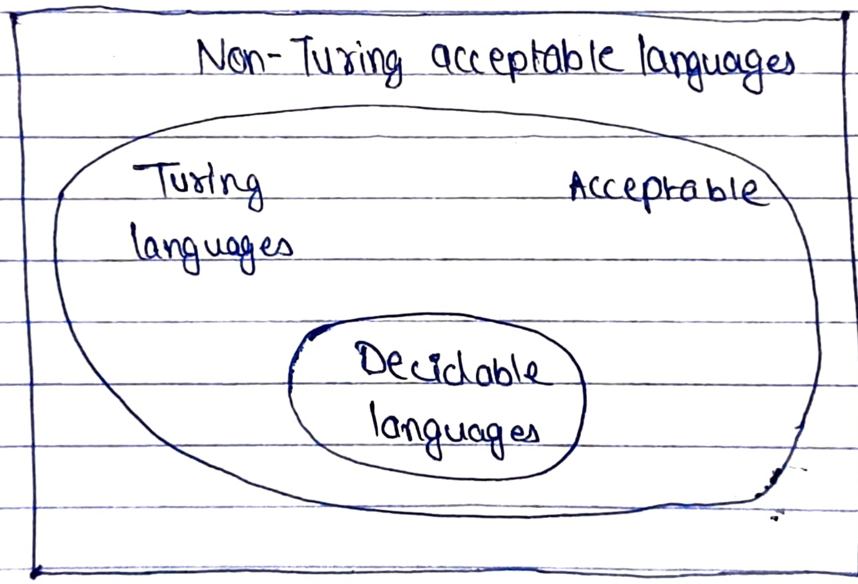
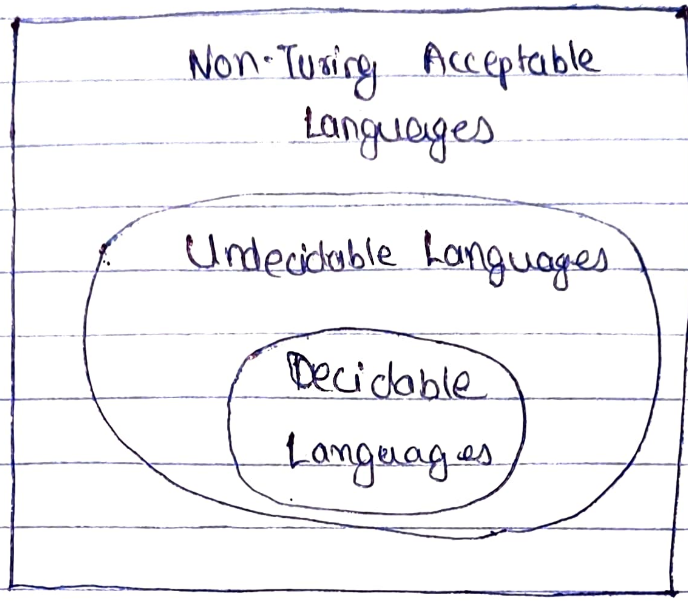
Q. 1.

Ans. A language is called Decidable or Recursive if there is a turing machine which accepts and halts on every string w. Every decidable language is Turing - Acceptable.



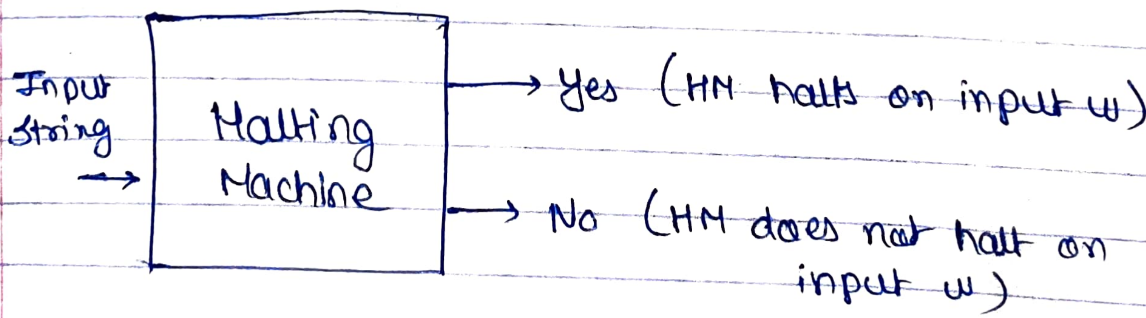
For an undecidable language, there is no Turing machine which accepts the languges and makes a decision for every input string w. A problem P is called "undecidable" if the language L of all yes instances to P is not decidable. Undecidable languages are not recursive languages, but sometimes they may be recurssively enumerable languages.



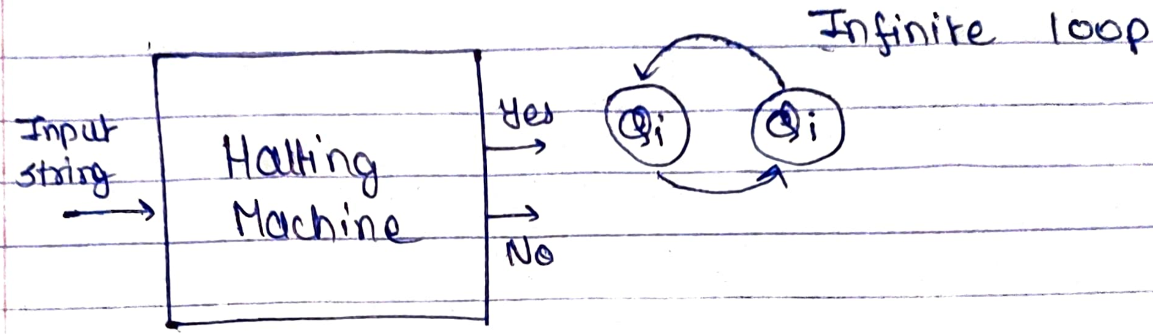
Q.2. Halting Problem on Turing Machine:

Ans. Input: A Turing machine and an input string w.

⇒ At first, we will assume that such a Turing machine exists to solve this problem and if the halting machine that produces / finishes in a finite amount of time, the outcomes as 'yes', otherwise as 'no'.



Now we have Inverted Halting Machine':



Further, a machine $(HM)_2$, which input itself is constructed as follows:

① If $(HM)_2$ halts on input, loop forever.

② Else halt.

Here, we have got a contradiction. Hence, the problem is undecidable.

Q.3.

Ans. The post correspondence problem (PCP), is an undecidable decision problem. The PCP problem is stated as follows: Given the following two lists, M and N of non-empty strings over Σ:

$$M = (x_1, x_2, x_3, \ldots, x_n)$$
$$N = (y_1, y_2, y_3, \ldots, y_n)$$

We can say that there is a Post Correspondence Solution, if for some $i_1, i_2, \ldots, i_k$, where $1 \le i_1 \le n$, the condition $x_{i_1} \ldots x_{i_k} = y_{i_1} \ldots y_{i_k}$ satisfies.

Example:

Find whether the lists M = (abb, aa, aaa) and N = (bba, aaa, aa) have a Post Correspondence Solution?

Soln.

	x_1	x_2	x_3
M	Abb	aa	aaa
N	Bba	aaa	aa

Here,

$x_2 x_1 x_3 =$ 'aaabbaaa'

and $y_2 y_1 y_3 =$ 'aaabbaaa'

We can see that

$x_2 x_1 x_3 = y_2 y_1 y_3$

Hence, the solution is $i = 2$, $j = 1$ and $k = 3$.