Language recognized by TM

For a Turing machine M, L(M) denotes the set of all strings accepted by M.

A language is Turing recognizable if some Turing machine recognizes it.

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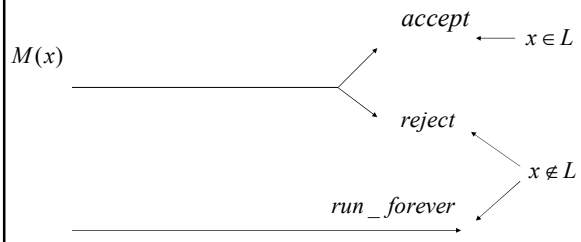
Turing Recognizable

- Turing machine M recognizes language L



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EQ_{TM} .

EQ_{TM} ={<A,B>| A and B are Turing machines and L(A)=L(B)}

Theorem: Neither EQ_{TM} nor its complement is Turing recognizable

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Proof

We first prove $A_{TM} \leq_m \overline{EQ_{TM}}$

For input <M,w> for A_{TM}

TM M1: rejects any input

TM M2: accepts any input if M accepts w.

It is easy to see L(M1) not equal L(M2) iff M accepts w

So, $< M, w > \in A_{TM} \Leftrightarrow < M_1, M_2 > \in \overline{EQ_{TM}}$

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Proof

We prove $A_{TM} \leq_m EQ_{TM}$

For input <M,w> for A_{TM}

TM M1: accepts any input

TM M2: accepts any input if M accepts w.

It is easy to see L(M1)=L(M2) iff M accepts w

So, $< M, w > \in A_{TM} \Leftrightarrow < M_1, M_2 > \in EQ_{TM}$

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Problem

Show that the language F={M| M is a Turing machine , and L(M) contains infinite elements} is not Turing recognizable.

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