

Problem

Show that $\overline{EQ_{TM}}$ is recognizable by a Turing machine with an oracle for A_{TM} .

Step-by-step solution

Step 1 of 1

Given:

A language that is recognizable by an oracle Turing machine.

Construction:

Consider Turing Machine T with an oracle for A_{TM} and consider 2 more Turing machines P and Q that will work as decider for T and then T will work as a decider for A_{TM} and further A_{TM} will work as a Turing recognizable for $\overline{EQ_{TM}}$. Use the following approach:

$$(P, w) \in A_{TM} \longleftrightarrow T(\langle M, w \rangle) \in EQ_{TM}$$

Above statement can be applied by using following algorithm:

T = on input $\langle P, w \rangle$

Where w is an input string and running on P

• Construct 2 Machines P and Q

P = On any input: accept.

Q = On any input: run P on w , if it accepts, accept

• Output $\langle P, Q \rangle$

Conclusion:

Here, it is quite obvious that T is working as a decider for A_{TM} and then A_{TM} for $\overline{EQ_{TM}}$. This way $\overline{EQ_{TM}}$ is recognizable by a Turing Machine with an oracle for A_{TM} .

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