

1. Show that L is decidable if and only if L and \bar{L} are both semi-decidable.
2. $\text{ACCESSIBLE} = \{(M, q) \mid \text{there is an input } x \text{ on which } M \text{ reaches the state } q\}$. Show that this is undecidable.
3. Let U be a TM that semi-decides HP. (ie., $L(U) = \text{HP}$.)
Fix $(M, x) \mapsto (M')$ as follows
 M' on input y
 1. Write x to a tape.
 2. Run M on input x .
If M accepts, run U on y and accept if U accepts(a) Analyze $L(M')$.
 1. M accepts $x \Rightarrow L(M') = ?$
 2. M does not accept $x \Rightarrow L(M') = ?$(b) Use this to argue that it is undecidable to check if a given Turing Machine accepts a decidable language. That is, show that the following language is undecidable.

$$A = \{M : L(M) \text{ is undecidable} \}$$