CS 254: Computability and Complexity	**Anonymous submission**
Problem Set #07	*October 31, 2019*

1. Prove that there is a decider for N for A/B

   Proof by contradiction:

   Lets assume we can build a decider N

   We learned from problem set 2 that if B = $\emptyset$ then A/B = $\emptyset$

   Therefore our decider N will be able to decide E_{TM} where E_{TM} = $\{M|$ M is a TM and L(M) = $\emptyset\}$.

   N on input D, M:

   1. output C
   2. run C on any string
      i. If C accepts, reject M
      ii. If C rejects, accept M

   If $M \notin \text{E}_{TM}$ then N can decide M as L(M) = Σ^* because it can halt on $M \neq \emptyset$

   However if $M \in \text{E}_{TM}$ then N can decide E_{TM} which we know is undecidable by theorem 5.2. This means our assumption about N must be wrong and that there is a contradiction! Therefore A/B is undecidable