Problem Set 4

This problem set covers the material of lectures 20 and 21. This problem set is not due and it will not be graded, but you are welcome to come to office hours to discuss your solutions. In the second midterm and in the final you will not be tested on the material of lectures 22-24.

---

1. Say that a decision problem C is *recognizable-complete* if it is recognizable and for every recognizable problem R we have $R \leq C$.

   (a) Prove that the Halting Problem is recognizable-complete.

   (b) Prove that if C is recognizable-complete then $\bar{C}$ is not recognizable.

2. Consider the decision problem IOH (for *Infinitely Often Halting*) defined as follows. An input for IOH is a program P. The question is whether there are infinitely many different inputs x such that P halts on input x. Prove that IOH is not recognizable.

   [Hint: reduce from the complement of the Halting Problem]