Complete this checkpoint on your own, and email your solution to ndobson@andrew.cmu.edu by 11:59 PM on March 21st with “[FLAC checkpoint 6]” in the subject.
Your work should be legible and preferably typed, but you don’t have to use TeX.

1 Technology vs. Magic

Is an oracle Turing machine a Turing machine? (Hint: The answer is no.) Why not?

2 Why Technology Is Better

(a) Construct a decider for Total making use of a (putative) decider for Halts. You do not need to give a proof of correctness (just this once!).

(b) Explain where the above construction fails if the decider is replaced with an oracle.

(c) Prove that Total is not decidable in Halts—that is, an oracle Turing machine with an oracle for Halts cannot decide Total. You may use results from the homework.

(d) Based on the above, explain intuitively how oracles are weaker than deciders. (Hint: Think about types.)

3 Why Magic Is Better

(a) Prove that a (putative) decider for Halts cannot decide Halts. (Your solution should be at most two lines long.)

(b) Explain where the above proof fails if the decider is replaced with an oracle Turing machine.

(c) Based on the above, explain intuitively how deciders are weaker than oracles.

4 Types of Reductions

(a) Decide with proof whether there exist a Turing reduction from Total to Halts. (Your solution should be at most two lines long and should reference a previous problem.)

(b) Which statement is stronger (implies the other): $A \leq_m B$ or $A \leq_T B$?

(c) A Rudich reduction is a hypothetical type of reduction that I just made up. What does it mean for a language $A$ to be Rudich-complete for a class of languages $\mathcal{L}$?