Computer Science 4602
Fall 2021
Practice Quiz 2

You have 50 minutes. Answer all of the questions on the exam. Circle the letter of the best answer to the multiple-choice problem (marked [MC]), even if no answer is ideal. You may use one prepared 8.5×11 sheet of paper during the exam. **Check your work**.

1. Write a clearly legible T to the **left** of each of the following that is true, and a clearly legible F to the **left** of each that is false.

   (a) Every infinite language is uncomputable.

   (b) Every finite language is computable.

   (c) Every enumerable language is computable.

   (d) Turing machines are capable of computing all languages.

   (e) A Turing machine with 2 tapes can compute a language that cannot be computed by any Turing machine with 1 tape.

   (f) The Halting Problem is conjectured to be uncomputable, but that conjecture has not been proved.

2. [MC] One way to prove that a set A is uncomputable is to show that

   (a) $\overline{A}$ is partially computable.

   (b) $\overline{A} \leq_m \overline{HLT}$.

   (c) $HLT \leq_m A$.

   (d) $A \leq_m HLT$.

3. If p is a program, define $L(p)$ to be the set $\{x \mid p(x) \cong 1\}$. Let $A = \{p \mid L(p)$ is a finite set$\}$.

   (a) Is A a finite set?

   (b) Is A computable? Justify your answer. You will receive no points for a yes or no answer without convincing justification.

4. Let $B = \{n \mid n$ is a positive integer that can be expressed as the sum of two prime numbers$\}$. For example, $8 \in B$ since $8 = 5 + 3$. Is B computable? Justify your answer. You will receive no points for a yes or no answer without convincing justification.

5. Suppose A is the set of programs $\{p \mid$ the last character of program p is a right brace$\}$ and $B = \{p \mid p(0)\!\uparrow\}$. Give a mapping reduction from A to B.

6. Suppose $A = \{p \mid p(0) = 5\}$ and $B = \{p \mid p(0) = 10\}$. Give a mapping reduction from A to B. Be sure that you know what properties the reduction needs to have before you start to describe the reduction.