

Name: _____

Exercise B3, 2/18/05**Halting and Other Haunting Problems**

Today, we discussed how to prove the main problems including the halting problem. Since this is one of the main ideas in the Theory of Computation, we will reinforce our ability to explain the proofs in this exercise.

Task: Write up an informal proof *in your own words*, for *each* of the four main problems below. When you write, make sure that you understand everything you write. If you have uncertainty, note it as it appears. Naturally, you can identify and re-use certain mathematical tools shared by multiple problems (i.e., no need to be repetitive). Be prepared to give a mini presentation of your proof in class; you may be assigned to any of these problems.

- The universal language is semi-decidable.
 $ACCEPT_{TM} = \{(M, w) \mid \text{TM } M \text{ accepts } w\}$
- The complement of universal language is non-TM-recognizable.
 $NACCEPT_{TM} = \{(M, w) \mid \text{TM } M \text{ does not accept } w\} = (ACCEPT_{TM})'$
- The halting problem is semi-decidable.
 $HALT_{TM} = \{(M, w) \mid \text{TM } M \text{ halts on } w\}$
- Infinite loop detection is non-TM-recognizable.
 $LOOP_{TM} = \{(M, w) \mid \text{TM } M \text{ loops on } w\} = (HALT_{TM})'$

Note: You may use any method, e.g., *Turing Omnibus* (Ex B1), class discussion today, another approach in the literature, and/or your own ideas.

Survey: Time spent between classes: _____

// End