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Quiz 3

October 27, 1994

Try to keep your answers succinct.

1. (10 points) What is the language accepted by the following Turing machine? (Recall that "1/BR" means on reading a 1, write a Blank and move Right.)



- 2. Show that the following are true:
 - (a) (7 points) If L is r.e., and $L \propto \overline{L}$, then L is recursive.
 - (b) (7 points) If L is recursive, then $L \propto 0^* 1^*$.
- 3. In this problem, we show that the following language is r.e., but not recursive:

 $L_{\text{steps}} = \{\langle M \rangle : \text{there exist distinct strings } w_1 \text{ and } w_2 \text{ such that } M \text{ accepts } w_1 \text{ and } w_2 \text{ in the same number of steps} \}$

- (a) (8 points) Show that L_{steps} is r.e. (Hint: It may help to write language L as $\{\langle M \rangle : \exists w_1, w_2, t \text{ s.t. } ... \}$.)
- (b) (6 points) Keeping in mind part (a), explain why we would **not** try to use each of the following possible reductions to show that L_{steps} is not recursive.
 - i. Why won't $0^*1^* \propto L_{\text{steps}}$ help?
 - ii. Why won't $L_{\text{steps}} \propto L_u$ help?
 - iii. Why won't $\overline{L_u} \propto L_{\text{steps}}$ help?
- (c) (8 points) Prove that L_{steps} is not recursive by showing that $L_u \propto L_{\text{steps}}$. (If you cannot do this part, at least be clear about what "you want" from your reduction.)
- (d) (4 points) Is the complement of L_{steps} r.e.? Why or why not?

1.	/10
2.	/14
3.	/26
Total	/50