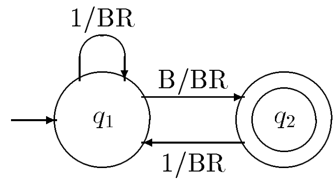
Name ________________________________

CS-172 Quiz 3 October 27, 1994

David Wolfe

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 $\{\langle M \rangle : \exists w_1, w_2, t \text{ s.t. } \ldots\}$.)

   (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