Foundations of CS Spring 2009 Name ____Solution_____

Dr. Kay Quiz 12: April 30, 2009 Open book. 20 minutes.

Consider a Turing machine that starts with the tape head on the first character in the string (or on a blank if it is the empty string) and copies the last character in a string to the front of the string and then halts. For example:

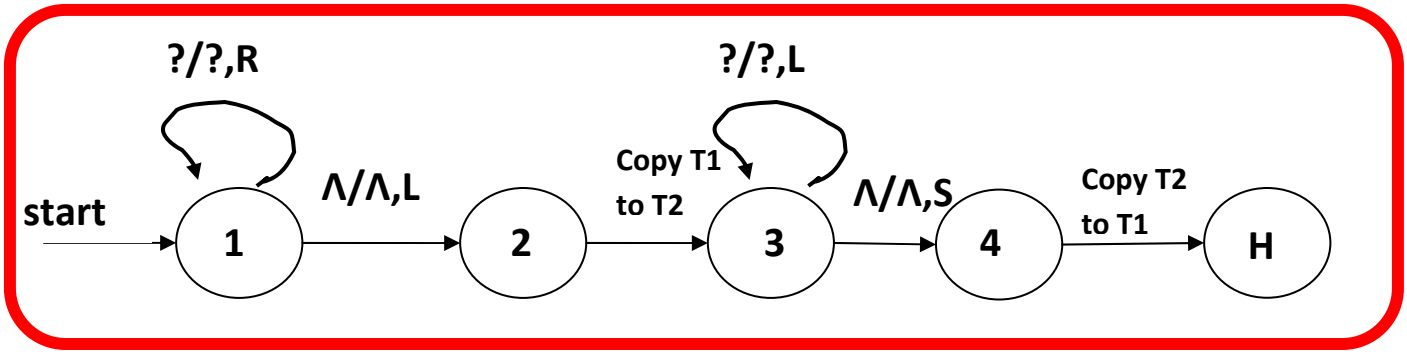
Input String	Final String
Hello	oHello
A	Aa
<blank>	<blank>

Assume that the TM has a second tape that you can copy one character to.

Question 1a (1 point): Describe in English how your Turing machine will do this.

Call the tape heads T1 and T2. Move T1 to the right until you see a lambda. Then move T1 one space to the left and copy T1-> T2. Move T1 to the left until you see a lambda. Copy T2->T1.

Question 1b(4 points): Draw such a TM, or list the 5-tupels that define such a TM



Question 2a(1 point): Add parenthesis to the following WFF:

$$\big(A \to (B \vee C)\big) \equiv ((A \to B) \vee (A \to C))$$

Question 2b(4 points): Verify the above equivalence by writing an equivalence proof (i.e. start on one side, and use known equivalencies (mostly on page 354) to get to the other side

$A \to B \vee C \equiv \backsim A \vee (B \vee C)$ conv 1

$\equiv \backsim A \vee \backsim A \vee (B \vee C)$ disjunct 3

$\equiv \backsim A \vee (\backsim A \vee B) \vee C$ associativity

$\equiv (\backsim A \vee B) \vee (\backsim A \vee C)$ commutativity

$\equiv (A \to B) \vee (\backsim A \vee C)$ conv 1

$\equiv (A \to B) \vee (A \to C)$ conv 1