Name: Anne Surkey

Quiz 3

1. (25 points) Consider TM1:

Write the resulting configurations for the following input string. (If there are more than 8 configurations, you may just provide the first eight.) Assume the read/write head starts on the left-most character.

Input on tape: accacc

Input on tape: aaacc

q_1 accacc
q_2 bccacc
q_3 bccacc
q_3 bccacc
q_4 ~dccacc
q_{reject} ~dccacc
q_1 aaacc
q_2 baacc
q_1 baacc
q_2 babcc
q_3 babcc
q_3 babcc
q_4 badcc
q_4 badcc
2. (15 points) Provide an informal description for the Turing Machine that decides \( L_3 = \{ x^n y^{2n} z^{n+1} \mid n > 0 \} \). In other words, right 1-4 sentences describing this TM’s operation.

Starting with left-most \( x \), loop for each \( x \): cross out left-most \( x \), two left-most \( y \)’s, and left-most \( z \). If run out of \( y \)’s or \( z \)’s before finish \( x \)’s, reject. When run out of \( x \)’s: if no \( y \)’s left and exactly one \( z \) left, accept. Otherwise, reject.

4. (15 points) Certain languages cannot be recognized by certain machines. For each language, state the simplest type of machine that can recognize it (your answer will either be: “Finite State Machine”/FSM, “Push Down Automaton”/PDA, or “Turing Machine”/TM:

a. \( L_6 = \{ w#w^R \mid w \in (aUb)^* \} \) (e.g., 01#10, 1101#1011, 00#00)

PDA

b. \( L_7 = \{ b^{2^n} \} \) (e.g., b, bb, bbbb, bbbbbbbb)

TM

c. \( L_8 = \{ w \mid w \text{ starts and ends with the same letter} \} \) (e.g., a, bbb, aba, baababb, aababa)

FSM