In answering the questions show all your work. No credit will be given for unsubstantiated answers.

1. Consider the Turing Machine $M_2$ given in Example 3.7 in the textbook. Provide answers to the questions below for each of the following input strings.
   (a) 0
   (b) 000

   Does the machine accept the string? If yes, prove that this is so rigorously using the definition of Turing Machine acceptance. If no, give the sequence of configurations leading to rejection and specify each transition using the transition function $\delta$. (Do not draw the transition diagram.)

2. Consider the Turing Machine $M_1$ given in Example 3.9 in the textbook.
   (a) Given the input $1\#1$, use the definition of Turing Machine acceptance to prove rigorously that $M_1(1\#1)^+.\downarrow$
   (b) Given the input $1\#\#1$, show the sequence of configurations leading to $M_1(1\#\#1)^-.\downarrow$

3. Give implementation-level (a.k.a design-level) description of Turing Machine that decides the following language over the alphabet $\{0, 1\}$.
   $$A = \{w \mid (w \in (0 \cup 1)^*) \land (|w| = 3k \text{ for } k > 0) \land (\text{number of 0s in } w \text{ is } k) \land (\text{number of 1s in } w \text{ is } 2k)\}$$

4. Problem 3.9 from the textbook.