1. (a) Give a Deterministic Turing Machine that takes as input two binary integers, decides if the first integer is larger. The input starts with a “$” and the two numbers are separated by a “$”. If it is larger the machine should print “Y”, otherwise it should print “N”, on an otherwise blank tape.

(b) Give a Deterministic Turing Machine that takes as input two binary integers, separated by a comma, and outputs a “$” followed by the larger one (on an otherwise blank tape).

2. (a) Let the language \( L = \{w\$w|w \in \{a, b\}^*\} \). Give a Deterministic Turing Machine that recognizes \( L \). If the input is in \( L \) the machine should print “Y”, otherwise it should print “N”, on an otherwise blank tape.

(b) Let the language \( L = \{w\$w|w \in \{a, b\}^*\} \). Give a Nondeterministic Turing Machine that recognizes \( L \). If the input is in \( L \) the machine should print “Y”, otherwise it should print “N”, on an otherwise blank tape.

3. Say that a write-once Turing machine is a single-tape TM that can alter each tape square at most once (including the input portion of the tape). Show that this variant Turing machine model is equivalent to the ordinary Turing machine model. (Hint: As a first step consider the case whereby the Turing machine may alter each tape square at most twice. Use lots of tape.) [Problem 3.11, p. 148 of Sipser.]