Turing Machines

1. Design turing machines to decide / recognize the following languages.

   (i) Language A of strings of the form w followed by mirror image of w, where w is a string on 0's and 1's. (e.g., 001100 is in A). Note that this is not the same as a palindrome.

   (ii) $0^N 1^N 2^N$, where $N \geq 0$ is an integer.

   (iii) Language of strings in which there are n a's followed by 2n b's (n is any nonnegative integer).

2. Design a turing machine that computes the square of a given number.

3. Complete the details in the simulation of a 2-way infinite tape turing machine using a one way tape turing machine.

4. A *Turing machine with a stay put move instead of left* is similar to an ordinary Turing machine except that the *direction* D of possible moves is chosen from the set $\{R, S\}$ where R means tape head moves right, and S (for *stay*) means tape head remains in the current tape cell itself.
   Show that this Turing machine is not equivalent to the general Turing machines. What is the class of languages these turing machines can recognize? (*Hint* : Such a Turing machine can only recognize regular languages. Give a proof.)