ASSIGNMENT 6: TURING MACHINES

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1. Write Turing machine code to compute addition in unary notation. Thus, for input `111 11` we get output `11111`. Test your code on the Turing machine simulator at http://morphett.info/turing/turing.html

2. Write Turing machine code to reverse the input string. You may assume the input string contains only 1 and 0. Test your code on the simulator.

3. Write Turing machine code to compute successor in binary notation. Thus, for input `111011` we get output `111100`. Test your code on the simulator.

4. (Binary decrement). In the proof that primitive recursive functions are Turing computable, we will need a direct construction of a Turing machine that computes the predecessor of n in binary representation. Exhibit such a machine and test it on the simulator.

5. Sometimes Turing machines are defined using a one-way infinite tape instead of a two-way infinite tape as in Kleene's textbook. In a one-way infinite tape machine, when you try to execute "move left" from the leftmost square, nothing happens. Show that the same functions will be Turing computable with each definition by completing the two parts of this problem.

(a) Explain how, given a two-way infinite tape machine M, to simulate it by a machine with a one-way infinite tape. Hint: use even-numbered squares and odd-numbered squares respectively to simulate the right half and left half of the tape.

(b) Explain how, given a one-way infinite tape machine M, to simulate it by a machine with a two-way infinite tape.