

Assignment #3

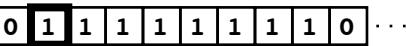
Due: Wednesday, October 26

Problem 1—Tracing Turing machine execution

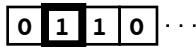
Solve the problems in the puzzle box on page 162 of the reader.

Problem 2—Calculating remainders

Write the program for a Turing machine $M_{\%3}$ that computes the remainder of its input when divided by 3. Given, for example, an input tape containing the number 8

...  ...

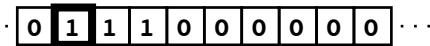
executing $M_{\%3}$ should leave the number 2 on the tape, because 2 is the remainder of 8 divided by 3.

...  ...

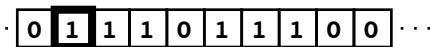
Note that your program must leave the tape head at the beginning of the remainder.

Problem 3—Duplicating a number

Implement a Turing machine M_{copy} that copies an input value on the tape, leaving two identical values on the output tape separated by a single **0**. Thus, if the input tape is

...  ...

the final configuration of the tape should look like this:

...  ...

Problem 4—The Busy Beaver problem

The solution for the BB(4) problem, which produces thirteen **1**s, is included in the library with the Turing machine simulator. To get a feel for how challenging this problem is, write a four-state Turing machine that produces at least eight but no more than twelve **1**s before stopping. It will probably help to look at the solution to BB(3) for ideas.