Theoretical Foundations Project 2

1 Purpose

This project will help you develop a deeper understanding of Turing Machines (TM).

2 Description

In this project you will implement a TM simulator that will compute a function on the input. This means that when the TM halts, the tape will contain the result of the function. The input is a TM (described below) and an input string. The output consists of a series of configurations.

3 Input

The TM will be input from a file named TM.txt.

1. The first line of your file will be a single integer that indicates how many states the TM contains. States are represented by consecutive integers starting from zero. State zero is always the start state.

2. The second line contains the number of the halting state.

3. The remaining lines represent the transitions. These will be stored in a table indexed by state number and character. The input file will have one line for each row of the table. Each row represents one transition, indicating the character to write on the current cell, the direction to move the read-write head, and the state to transition to. Blank cells will be represented using an underscore (_).

4 Output

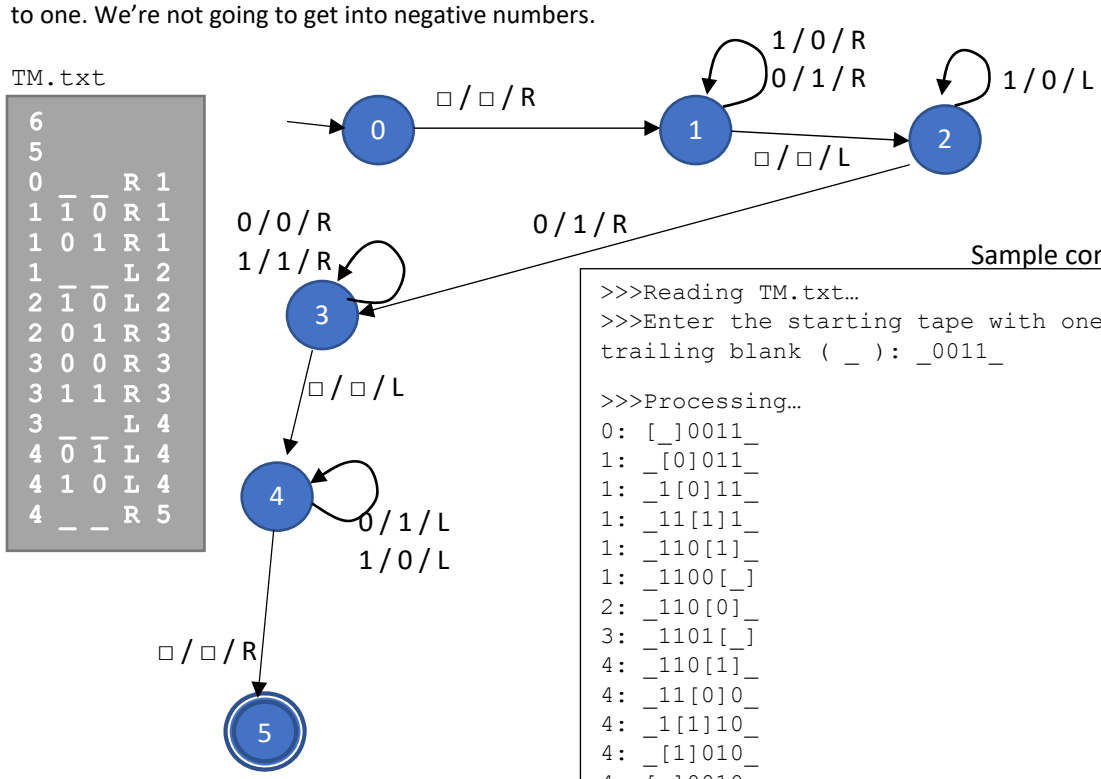
Output consists of a series of configurations, one per line of output. Each line should indicate the current state, and the contents of the tape, indicating the location of the read-write head.

5 Sample Input

The sample file is for a TM that decrements a binary number by one for any binary number greater than or equal to one. We're not going to get into negative numbers.

TM.txt

```
6
5
0 _ _ R 1
1 1 0 R 1
1 0 1 R 1
1 _ _ L 2
2 1 0 L 2
2 0 1 R 3
3 0 0 R 3
3 1 1 R 3
3 _ _ L 4
4 0 1 L 4
4 1 0 L 4
4 _ _ R 5
```



Sample console output

```
>>>Reading TM.txt…
>>>Enter the starting tape with one leading and one
trailing blank ( _ ): _0011_

>>>Processing…
0: [_]0011_
1: _[0]011_
1: _1[0]11_
1: _11[1]1_
1: _110[1]_
1: _1100[_]
2: _110[0]_
3: _1101[_]
4: _110[1]_
4: _11[0]0_
4: _1[1]10_
4: _[1]010_
4: [_]0010_
5: _[0]010_    [HALT]
```

Rubric

Code compiles: _____/5

Code reads a file in the local directory called “TM.txt”: _____/5

Code prompts user for an input string: _____/5

Produces the correct sequence on configurations: _____/25

Total: _____ / 40