NON-DETERMINISTIC TURING MACHINE SIMULATOR

Prova Finale of the “Algoritmi e Principi dell’Informatica” course @ Politecnico di Milano, A.Y. 2017-2018.

The Project

The goal of the project is the implementation, with the standard C programming language (only *libc*), of a Non-Deterministic Turing Machine, in its single-tape and only-acceptors variant.

The input is a well-formatted file where the following information are specified (in order):

- Transition Function;
- Final states (states where the input string is accepted);
- Max number of possible steps to perform per single computation (in order to avoid the problem of machines that do not finish computation);
- List of input strings.

More details on the input format at the end.

The expected output is a file which contains:

- 0 → If the input string is NOT accepted;
- 1 → If the input string is accepted;
- U → If the computation of the input string exceeds the specified max number of steps.

Useful Conventions

The following are useful conventions to use in the code:

- The symbols of the tape are *char*, while the states are *int*;
- The “blank” symbol is indicated by the character “_”;
- The machine starts always from state 0 and “positioned” to read the first character of the input string;
- Assume that the tape is infinite, both on left and on right, and that in each position it initially contains “_”;
- The characters “L”, “R”, “S” are used to represent the possible moves (respectively “LEFT” “RIGHT”, “STAY”);
- The input file is given by the standard input, while the output file should be given on the standard output.

Input File Format

The input file is divided into 4 sections:

1. The first section starts with the keyword “tr” and contains the transactions, one per line. Each character can be separated by the others by spaces.
   E.g.
   Transaction 0 a c R 1 means that the machine goes from state 0 to state 1 reading “a” and writing “c”. The head of the machine will then be moved to the RIGHT.
2. The following section starts with the keyword “acc” and lists the final states (states where the input string is accepted), one per line.
3. The third section starts with the keyword “max” and contains the max number of moves that are permitted to accept the input string.
4. The final section starts with the keyword “run” and lists all the input strings, one per line.