Documentation

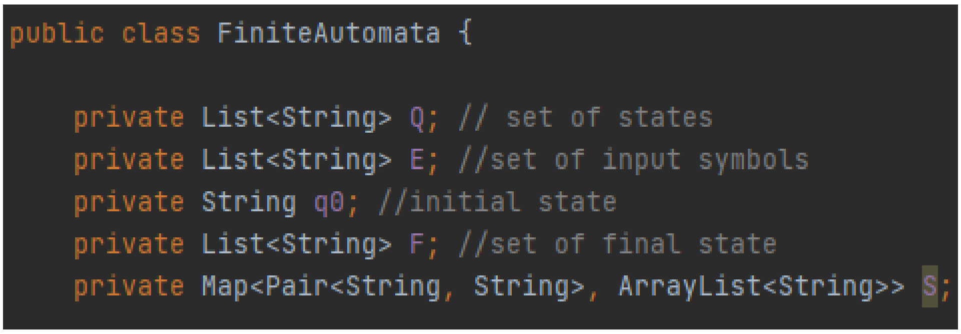
https://github.com/eugen1701/lab4flcd

The Finite Automata is structured as a class with 5 fields:

- Q - set of states
- E - set of input symbols
- q0 - initial state
- F - set of final state\
- S - transition function (S : Q X E --> Q)

S is represented as a map, where the key is a pair of state and input symbol (i.e. (x, 1)). This key is mapped to a list of destination states. (i.e. (x, 1) -> y). Which means x goes to y with value 1.

Finite Automata structure:



```java
public class FiniteAutomata {

    private List<String> Q; // set of states
    private List<String> E; //set of input symbols
    private String q0; //initial state
    private List<String> F; //set of final state
    private Map<Pair<String, String>, ArrayList<String>> S;
```

```java
public void read(String inputFile)
```

It reads the FA from the file given as a parameter and populates the fields shown upper with the proper data. If there are transitions with more than one destination, will put several states in the value of the map S, value represented as an ArrayList. If the transitions are in file multiple times, it will ignore the duplicates.

```java
public boolean isValid()
```

In order to check that a FA is valid we check if the initial state is among the set of states and if all the final states are among the set of states. Also, we do the same for the states in transitions and for the symbols in transitions we check if all of them are in the set of input symbols.

```java
public boolean isDfa()
```

In order to check that a FA is deterministic we go through all the dictionary keys and look if there is any list with a length greater than 1.

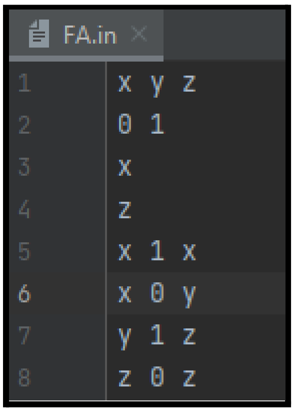
```java
public boolean isAccepted(String seq)
```

To see that a sequence is accepted by the FA, we iterate the symbols of the sequence and check that every symbol can be reached by following the FA transitions.

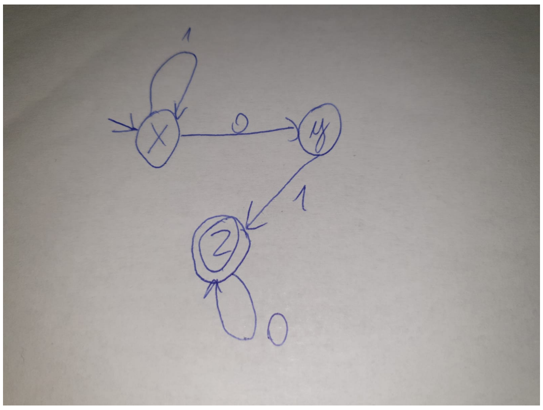
The file FA.in should contain:

- On the first line is the set of states (Q)
    - Q ::= <letters>
- On the second line is the set of input symbols (E)
    - E ::= <digits>
- On the third line is the initial state
    - q0 ::= <letters> (a state from Q)
- On the fourth line is the final states
    - F ::= <letters> (states from Q)
- The rest of the line are transitions (S ::= s1,s2,s3,..., si, ...,sn)
    - si ::= <letter> <digit> <letter> (letters represent the states from Q and the digit represents the input symobl)

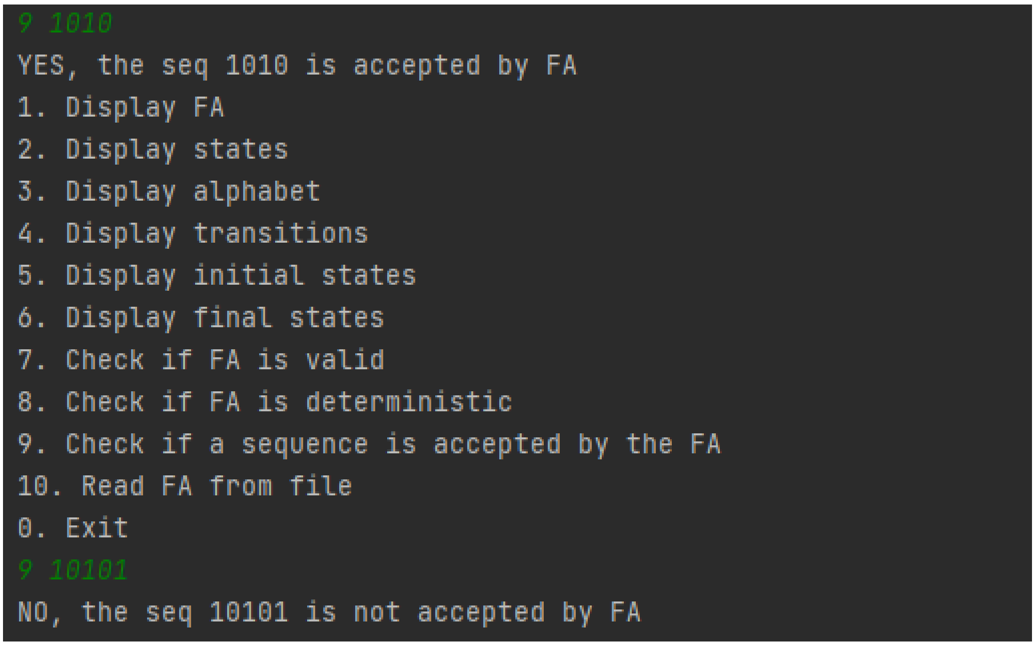
Example of FA.in
(deterministic)



```
x y z
0 1
x
z
x 1 x
x 0 y
y 1 z
z 0 z
```



Test to see if some sequences are accepted



```
9 1010
YES, the seq 1010 is accepted by FA
1. Display FA
2. Display states
3. Display alphabet
4. Display transitions
5. Display initial states
6. Display final states
7. Check if FA is valid
8. Check if FA is deterministic
9. Check if a sequence is accepted by the FA
10. Read FA from file
0. Exit
9 10101
NO, the seq 10101 is not accepted by FA
```