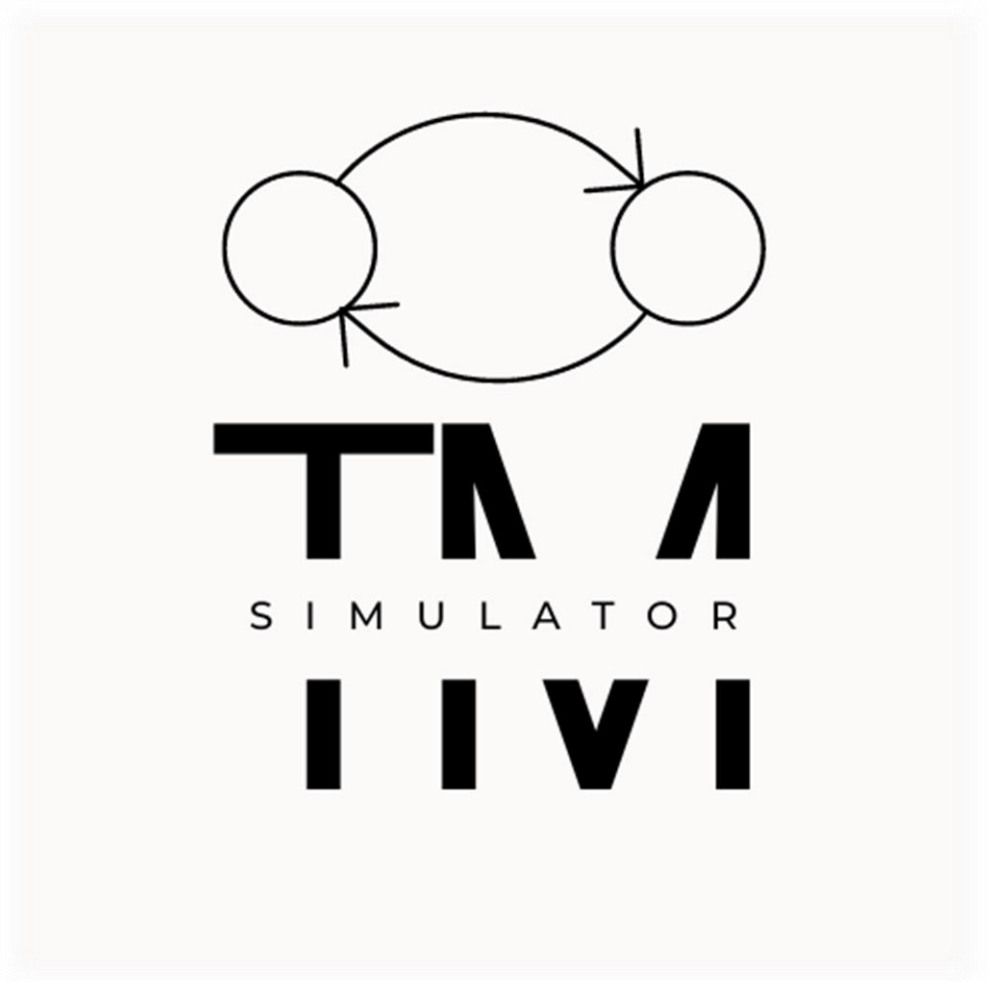
TURING MACHINE SIMULATOR

Manual



About Author

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Comments:

Making this program was a challenging but enjoyable experience. It was written in C++ in Qt Creator using the Qt framework, and it is my first major project.

My goal was to create an application that would allow the user to design a TM on a canvas and be able to test their input on it, watch an animation of tape movement and get a summary of all the information they may need to better understand the topic of theoretical computer science.

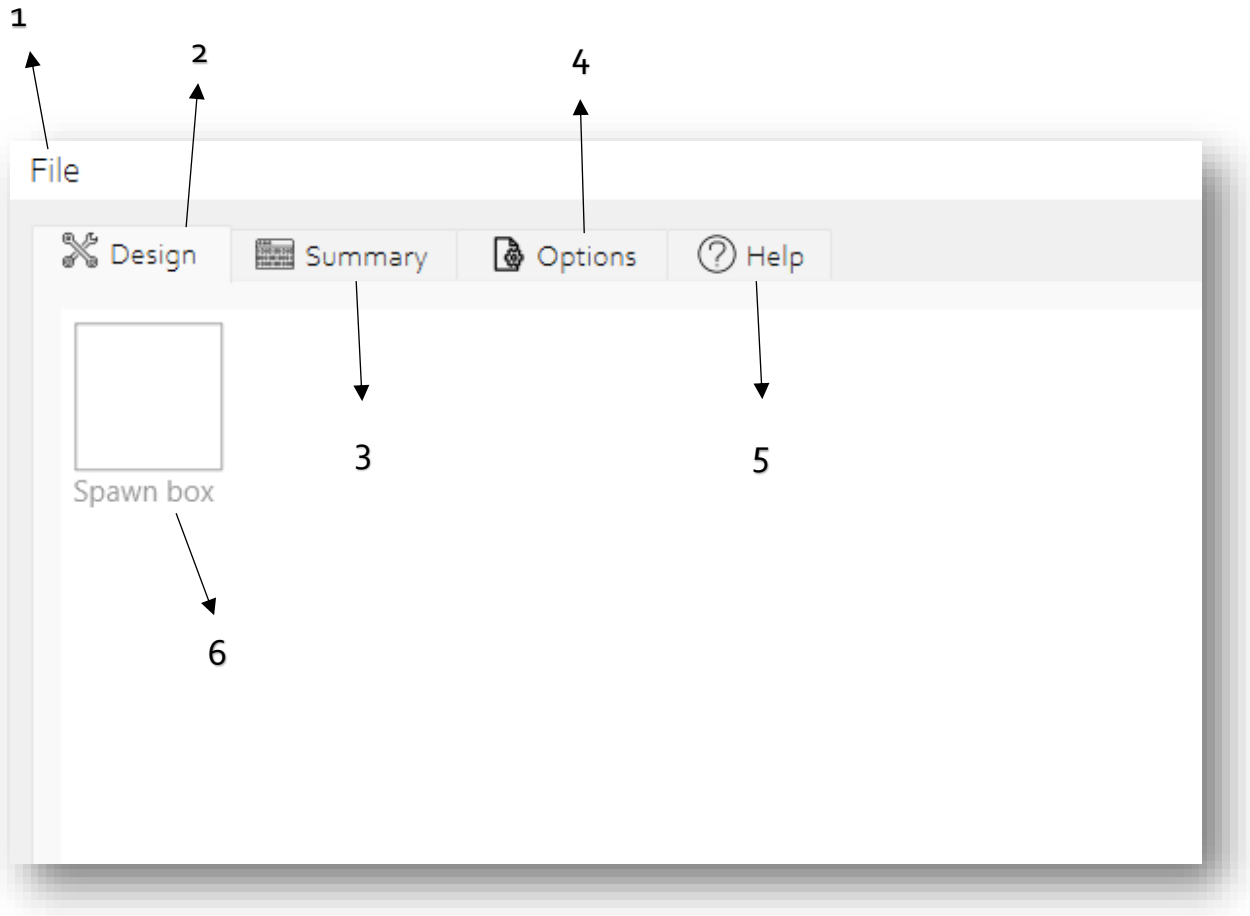
I hope that you enjoy using this program and I hope that it will be of help to you. Enjoy!

About TM Simulator

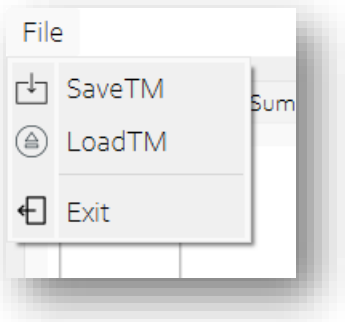
Programming Language:	C++
Framework:	Qt
License:	LGPL

All the Qt libraries that were used in this project can be found in the community version of Qt and are mainly int the QtCore, QtGui and QtConcurrent modules. The rest of the classes defined to make this project can be found on my Git, <link>.

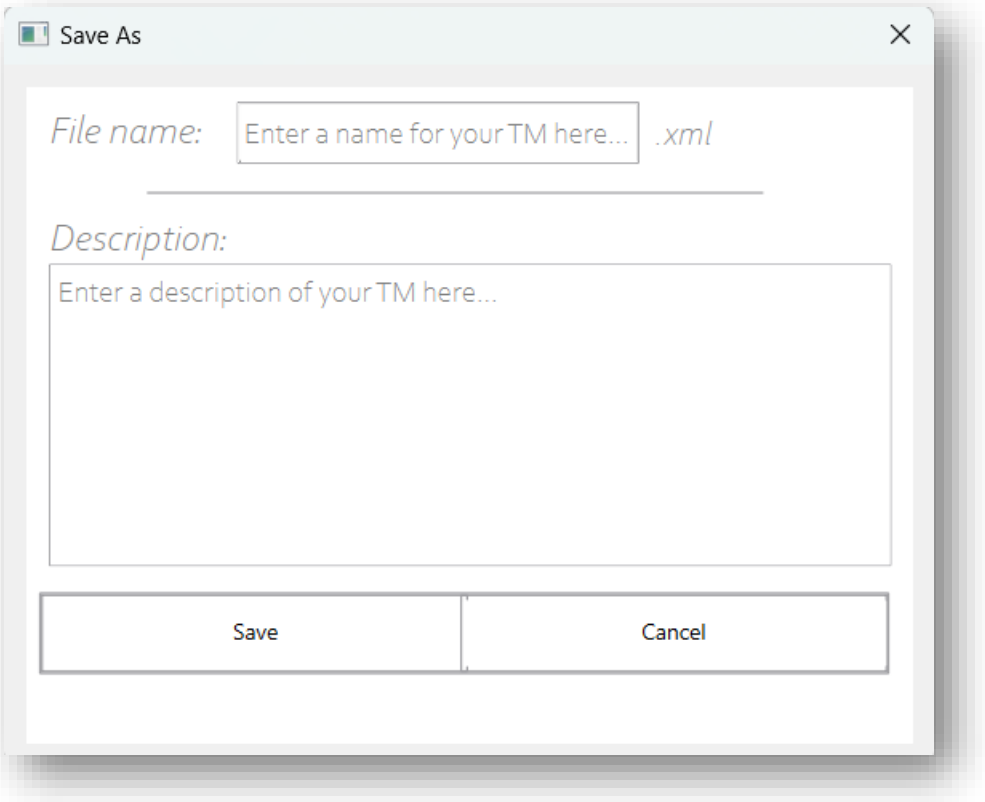
Feel free to modify and share this program as allowed by the LGPL license.


1
2
4
File
Design
Summary
Options
Help
Spawn box
3
5
6

1. File menu:


File
SaveTM
LoadTM
Exit
Sum

Save TM: Save your TM design. The TM is saved as an XML file.



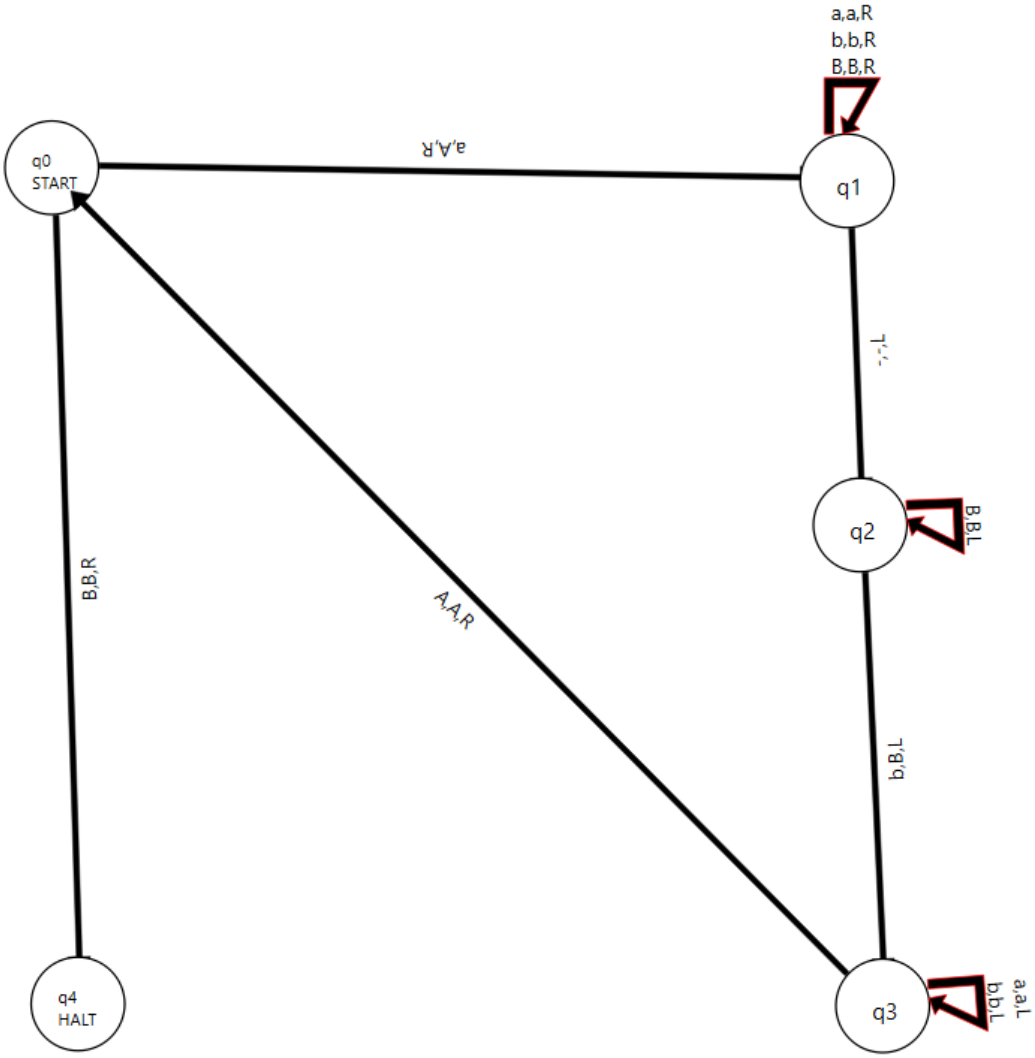
When you press ***SaveTM***, this window will pop up and allow you to give your TM a name and give a description of what the TM does or what language it accepts and save.

Load TM: Load a saved TM file.

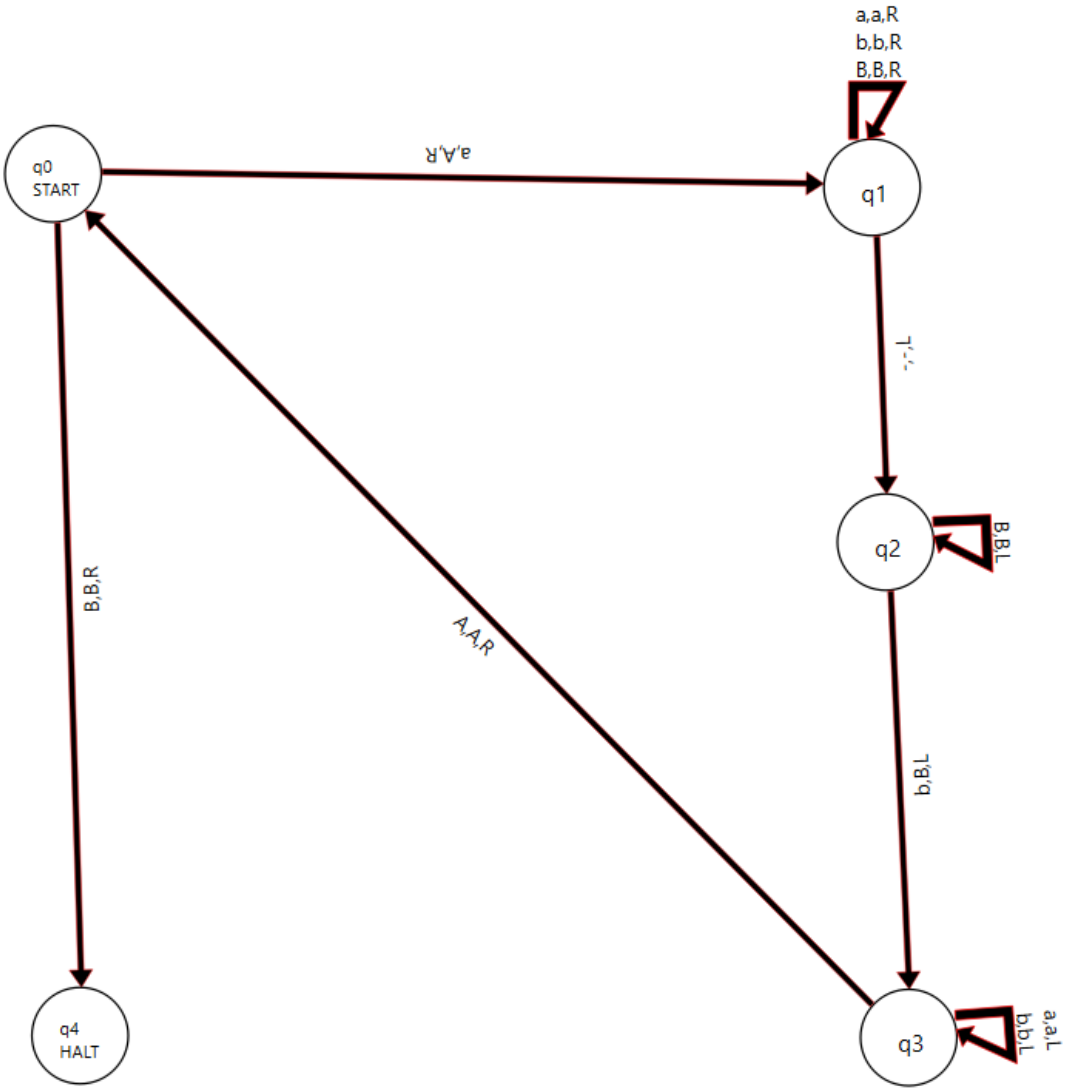
When loading a TM, the arrows will not be highlighted and connected. To connect the arrows to the states, run your mouse over the states and the arrows will connect to the states that they are in contact with. The arrows will highlight to show that they are connected.

Loop arrows are always highlighted because they are always connected.

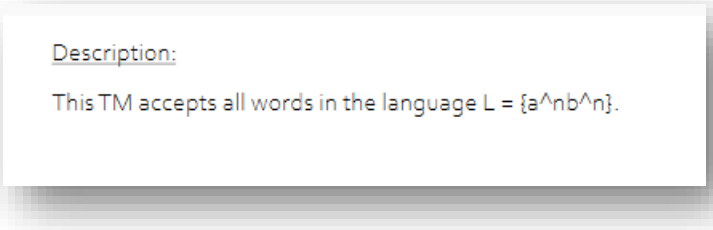
Before:


a,a,R
b,b,R
B,B,R
q0
START
a,A,R
q1
1,1,
B,B,L
q2
B,B,R
A,A,R
b,B,L
q4
HALT
q3
a,a,L
b,b,L

After:

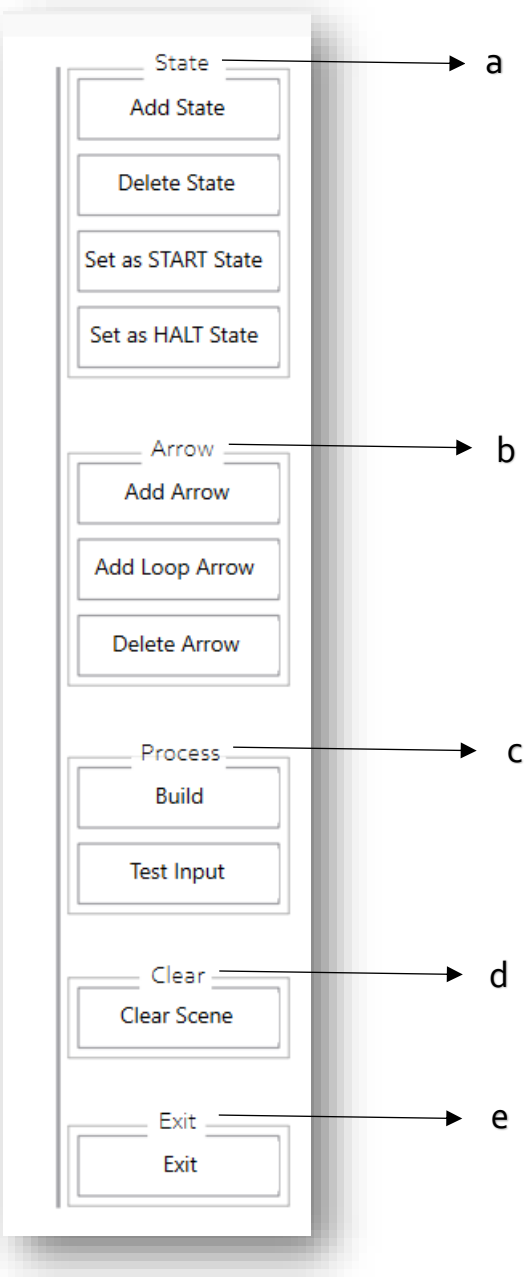


On the top right of the canvas, a description of what the TM does or what language it accepts will be shown for a few seconds for you to read then will fade away.



Exit: Exit the application.

2. Design:



a. **State**:

This set of buttons allow you to:

i. ***Add state***: Create a new state on the design canvas.
ii. ***Delete state***: Delete a state and its arrows.

iii. ***Set as START state***: Set the currently selected state as the start state.
iv. ***Set as HALT state***: Set the currently selected state as the halt state.

b. **Arrow**:

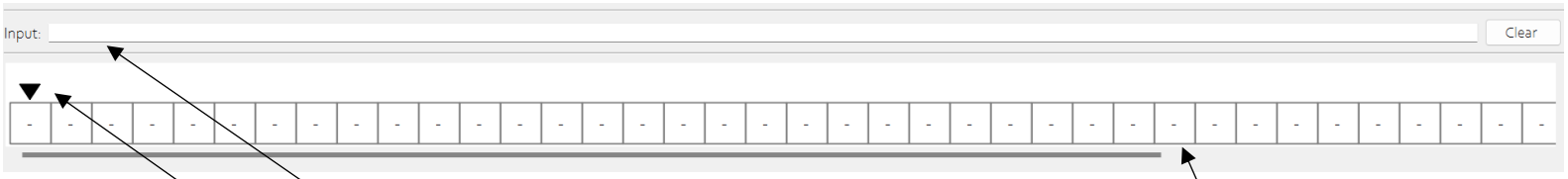
This set of buttons allow you to:

i. ***Add Arrow***: Create a new arrow on the currently selected state.
ii. ***Add Loop Arrow***: Create an arrow that points back to the selected state.
iii. ***Delete Arrow***: Delete the currently selected arrow.

c. **Process**:

This set of buttons allow you to:

i. Build: Create the logical TM in the computer. This is required in order to run inputs and test your TM.
ii. Test input: Test whether the input is accepted by the TM or not.



Input is entered in the input line edit and it will appear on the tape once entered.

When testing begins, the tape head will move, read, and write on the tape as per the design of your TM. It will follow the instructions on the edges.

The ***Clear*** button clears the tape, the input line edit and resets the tape head to the first cell.

d. **Clear**: The *Clear Scene* Button will remove everything from the design canvas and delete the model if the TM was built.

e. **Exit**: The *Exit* button closes the application. All unsaved changes or unsaved TMs are lost.

3. <u>Summary</u>:

The summary page contains 2 tables, the summary table, and the execution summary:

Summary Table

	From	To	Read	Write	Move
1	q0	q1	a	A	R
2	q0	q4	B	B	R
3	q1	q1	a	a	R
4	q1	q1	b	b	R
5	q1	q1	B	B	R
6	q1	q2	-	-	L
7	q2	q2	B	B	L
8	q2	q3	b	B	L
9	q3	q3	a	a	L
10	q3	q3	b	b	L
11	q3	q0	A	A	R
12	q4	H	A	L	T

Execution Summary

A a b b	q0	q1	a	A	R
A a b b	q1	q1	a	a	R
A a b b	q1	q1	b	b	R
A a b b	q1	q1	b	b	R
A a b b	q1	q2	-	-	L
A a b B	q2	q3	b	B	L
A a b B	q3	q3	b	b	L
A a b B	q3	q3	a	a	L
A a b B	q3	q0	A	A	R
A A b B	q0	q1	a	A	R
A A b B	q1	q1	b	b	R

Accepted

Crashed

Reason for crash: Input was accepted. No crash messge.

Summary Table:

This is the summary table of your TM. It records all transitions from state to state together with their read, write and move tape operations.

Execution Summary:

This is a table that is filled every time you test input. It provides a summary of the state transitions that took place, the read, write and move operations and also shows you the state of the tape before and after every transition.

The current letter that the tape head is over at each step is indicated by the colour red.

Accepted and ***Crashed*** **boxes**:

These two boxes indicate the result, whether the input was accepted or crashed. If the *Accepted* box is green, the input was accepted, and if the *Crashed* box is red, the machine crashed on the input.

If the machine crashed, the *Reason for crash* will tell you the exact reason for the crash.

4. Options:

Save Location: This is where the program will save your TM on your computer.

Play Speed: This is the speed of the TM and tape animation.

Tape Length: The length of the tape, maximum is 200 cells and minimum is 50 cells.

Arrow Highlight Colour: This is the colour that the arrow glows when it has been connected to a state.

Current state colour: This is the colour that the state changes to when testing input to indicate the current state.

5. Help

This tab contains button that provide brief summaries about the author, the application and the framework used to create the application, the Qt Framework.

This tab also contains the two licenses for this application that are required by Qt to be added. Since this application is open source, you can get the source code on git at the following link <link>. Please read the licenses and abide by their rules.