Assignment 4 - *Test Plan*

Step 1 - Default start

Start the main simulator through the command line by entering the command `python simulator.py`. You should see the three-window view as in Figure 1. The leftmost window should be the "Alphabet Builder", the middle the main simulator control window, and the rightmost window the "State Builder".

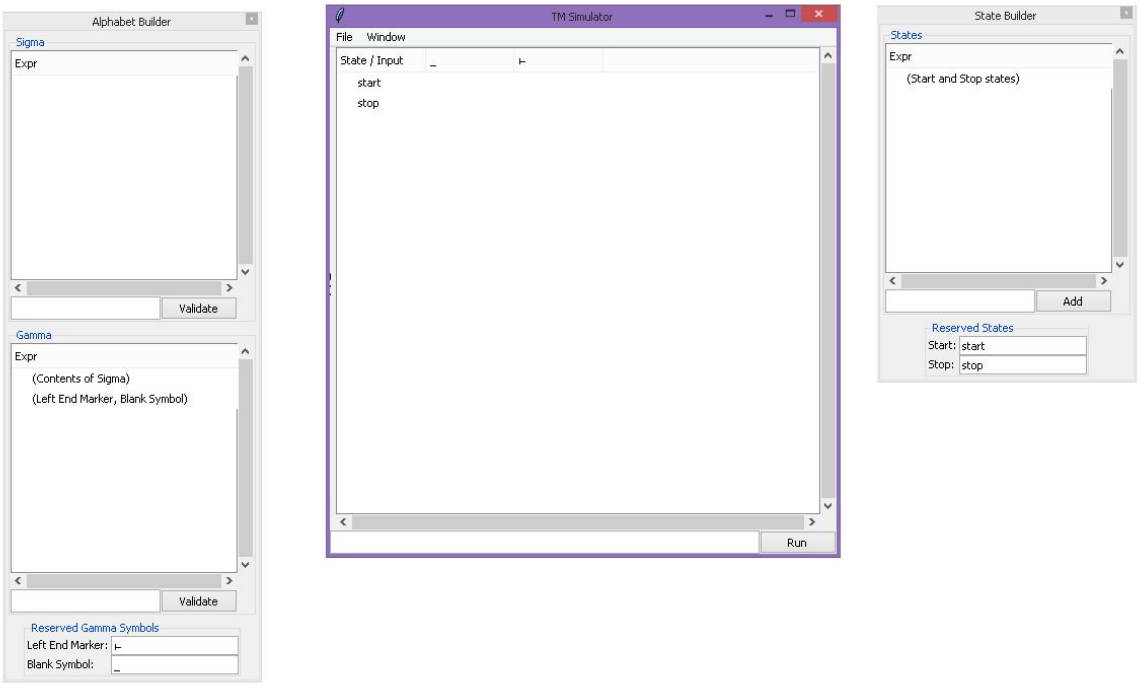

Figure 1: The default starting interface

Step 2 - Import and Export

This step tests the machine encoding import and export functions, as well as the default machine configuration.

Click the menu item "File > Export machine…". You should see the message box with the text "Machine encoding has been copied to clipboard". Open a text editor (for example, `notepad`), and paste the contents of the clipboard. It should match the following string:

```
gAMoXXEAXXEBXXECWAMAAADiiqJxA1gDAAAA4o61cQRdcQVdcQZYBQAAAHN0YXJ0cQdYBAAAAHN0b3 BxCHRxCS4=
```

Click the menu item "File > Import machine…". You should see the message prompt to enter a machine encoding as in Figure 2.

Enter the following encoding string:

```
gAMoXXEAKFgCAAAAcTFxAVgCAAAAcTJxAlgCAAAAcTNxA1gCAAAAcTRxBFgCAAAAcTVxBVgHAAAAcW
FjY2VwdHEGZV1xB1gBAAAAMHEIYV1xCShYAQAAAHhxCmgIZVgCAAAAfC1xC1gBAAAAIHEMXXENKGgDa
AyGcQ5oBGgIhnEPaARoCoZxEGgDaAiGcRFoAmgKhnESaAFoC4ZxE2gBaAiGcRRoAmgMhnEVaAVoDIZx
FmgFaAqGcRdoBWgIhnEYaAJoCIZxGWgDaAqGcRplXXEbKF1xHGgFaAxYAQAAAExxHYdxHmFdcR9oA2g
KWAEAAABScSCHcSFhXXEiaARoCmggh3EjYV1xJGgEaAhoIIdxJWFdcSZoAmgKaCCHcSdhXXEoaAFoC2
```

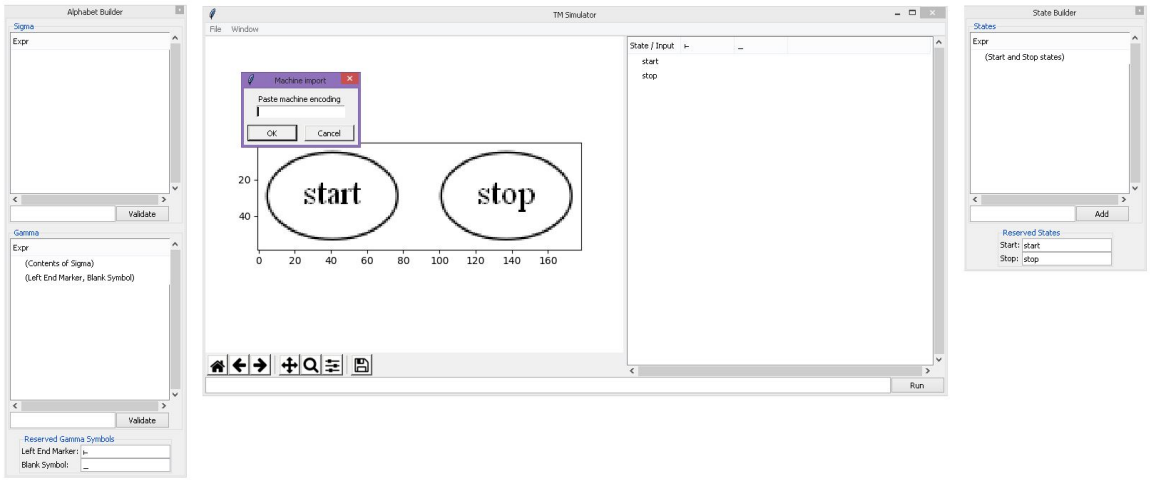

Figure 2: Machine input prompt

```
ggh3EpYV1xKmgCaAxoIIdxK2FdcSxoBmgMaCCHcS1hXXEuaAJoDGggh3EvYV1xMGgFaApoHYdxMWFdc
TJoBWgIaB2HcTNhXXEOaANoCmggh3E1YV1xNmgDaApoIIdxN2FlaAFoBnRxOC4=
```

and press OK to submit. The imported machine should match the following exactly, including imported Sigma, Gamma and left-end, blank symbols (Figure 3).

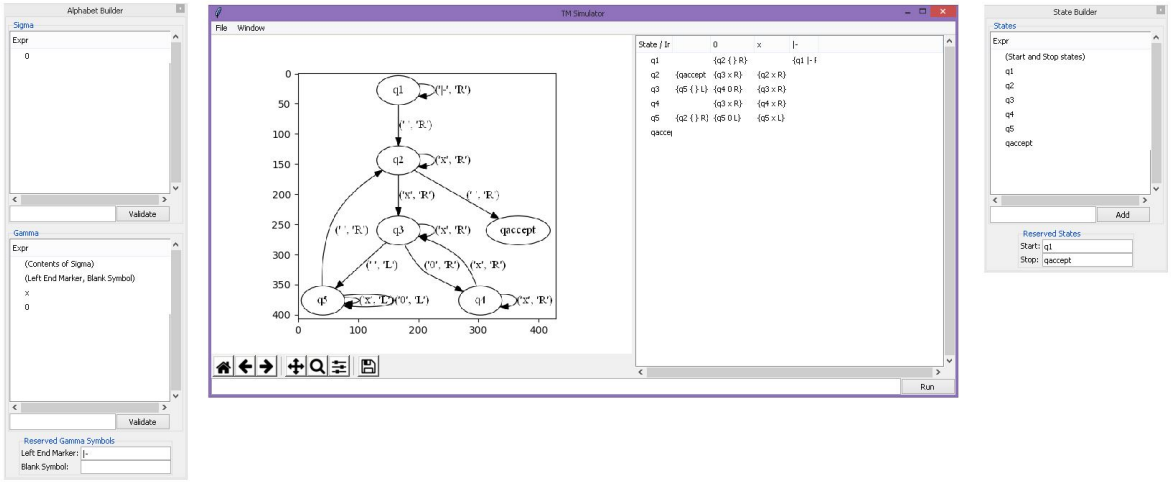

Figure 3: Successfully imported machine

Step 3 - Simulation

This step tests the machine simulation functions on an imported machine configuration.

Enter into the main simulator window's input box the string `0`. The "Run" button should be activated. Note that this implicitly initializes the input tape with the contents "Left-end marker, `0`". Click "Run" and the following message box should appear, indicating acceptance (Figure 4).

Accept this message box and the following window should appear, displaying the accepting computation trace (Figure 5).

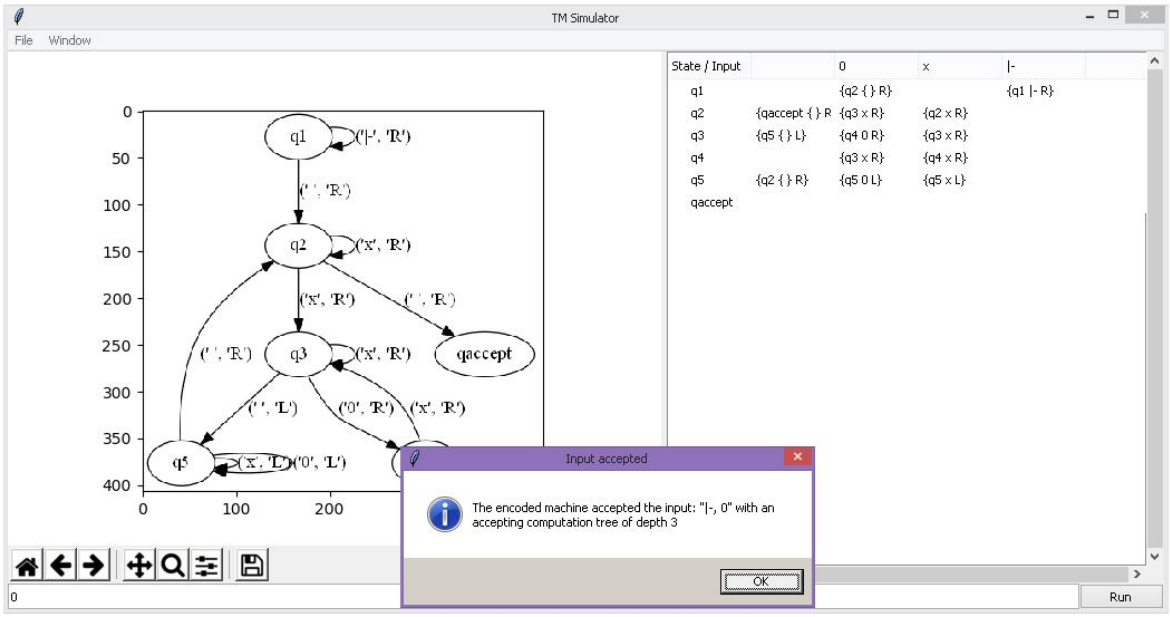

Figure 4: Machine accepted the input `|-,0`

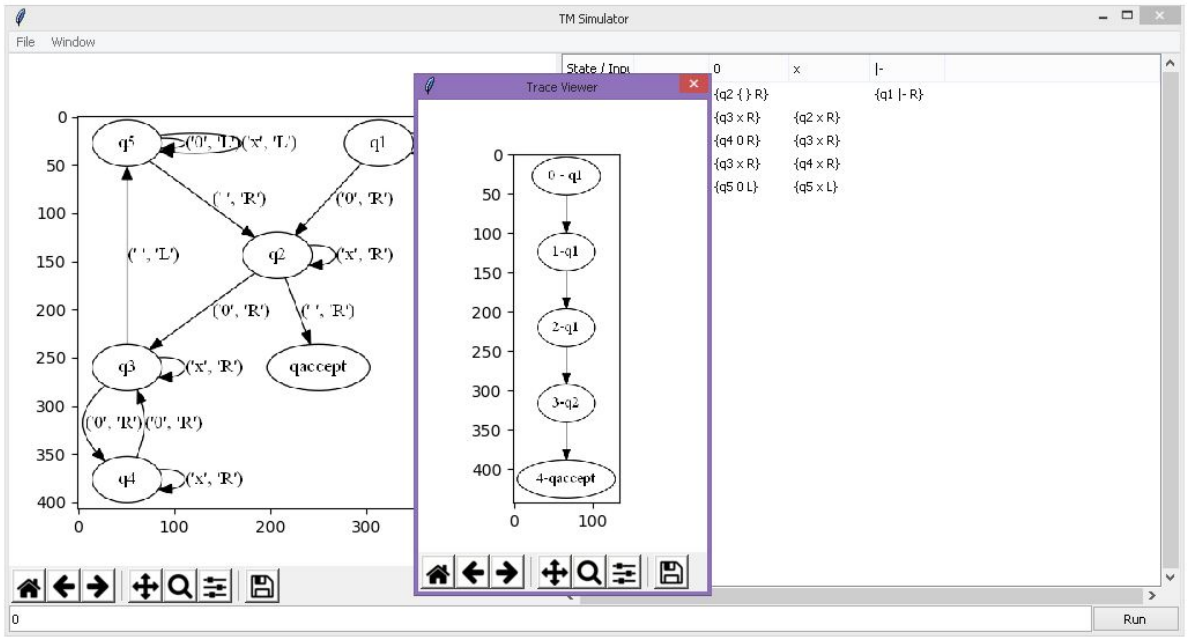

Figure 5: Trace of accepting computation

Step 4 - Editing

This step tests the machine edit and simulation functions on an edited machine configuration.

Start controlling the Alphabet Builder window. Enter `1` into the Sigma edit box and click "Validate" to add the symbol `1` into the Sigma alphabet. After doing so, the Alphabet Builder should look as in Figure 6, with `1` appearing in both the Alphabet Builder Sigma listing as well as the main window's transition table.

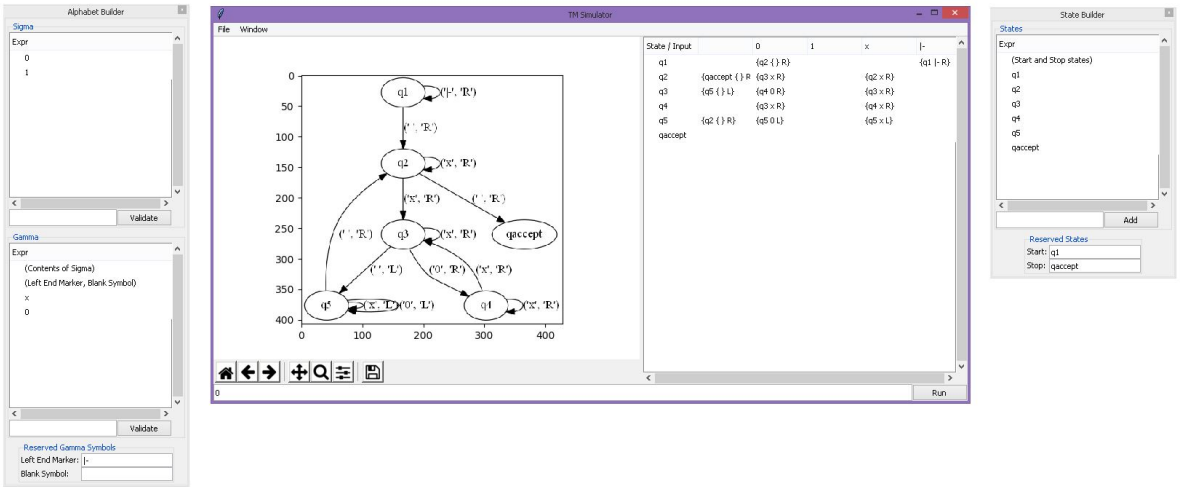

Figure 6: After adding the symbol `1` to Sigma

Double-click on the cell in the transition table under the column `1` and the row `q1` to edit the transition upon reading the symbol `1` while in the state `q1`. In the drop-down box for "Output state", select `q2`, for "Output symbol" select (blank), for "Head direction" select `R`. The window should then look like Figure 7.

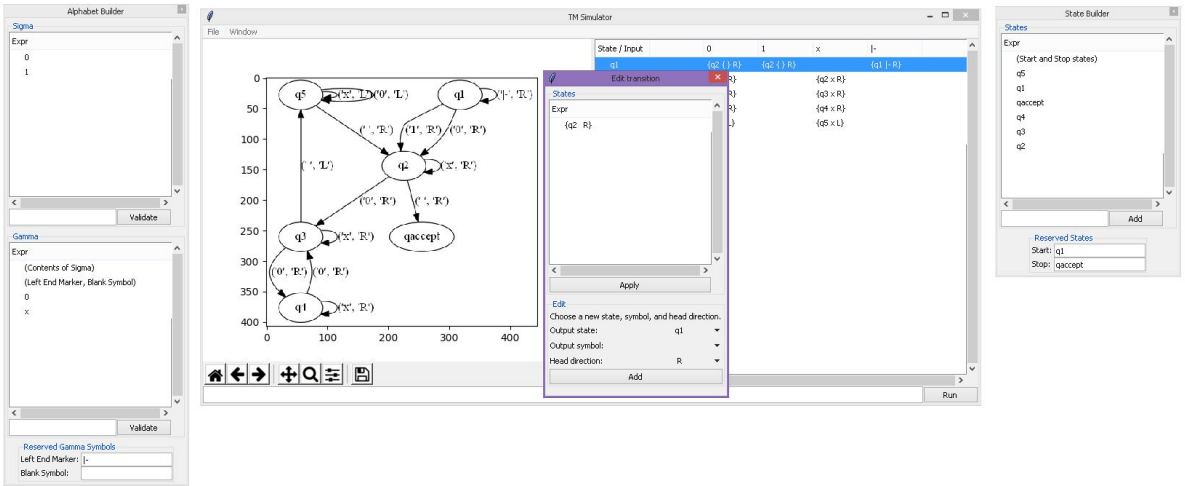

Figure 7: Editing transition for state `q1` upon reading `1`

Click "Add", then "Apply" to insert the transition; the main edit window should then look like Figure 8, with the correct transition inserted.

Enter into the main simulator window's input box the string `1`. The "Run" button should be activated. Click "Run" and the following message box should appear, indicating acceptance (Figure 9).

Accept this message box and the following window should appear, displaying the accepting computation trace (Figure 10).

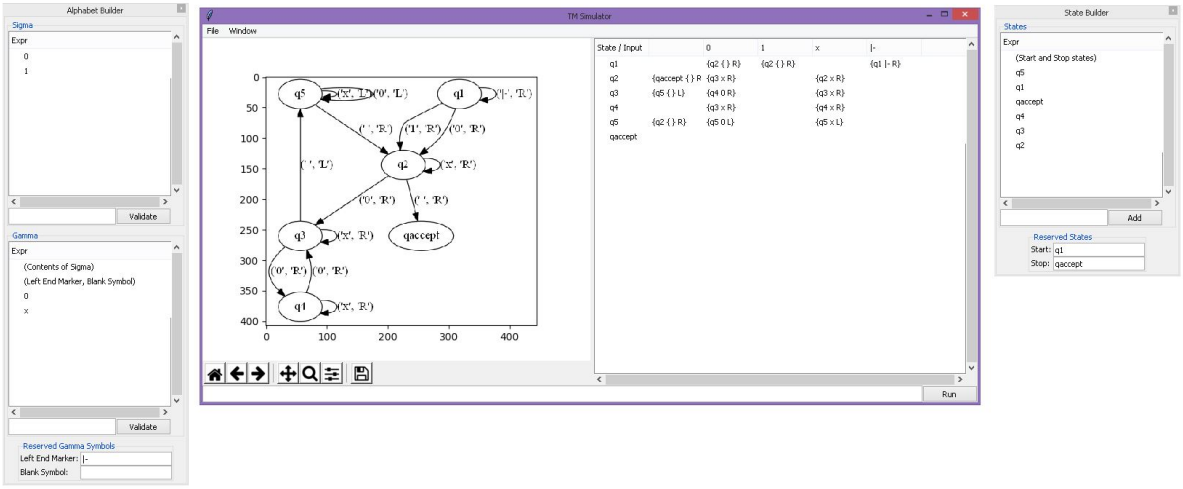

Figure 8: After editing transition

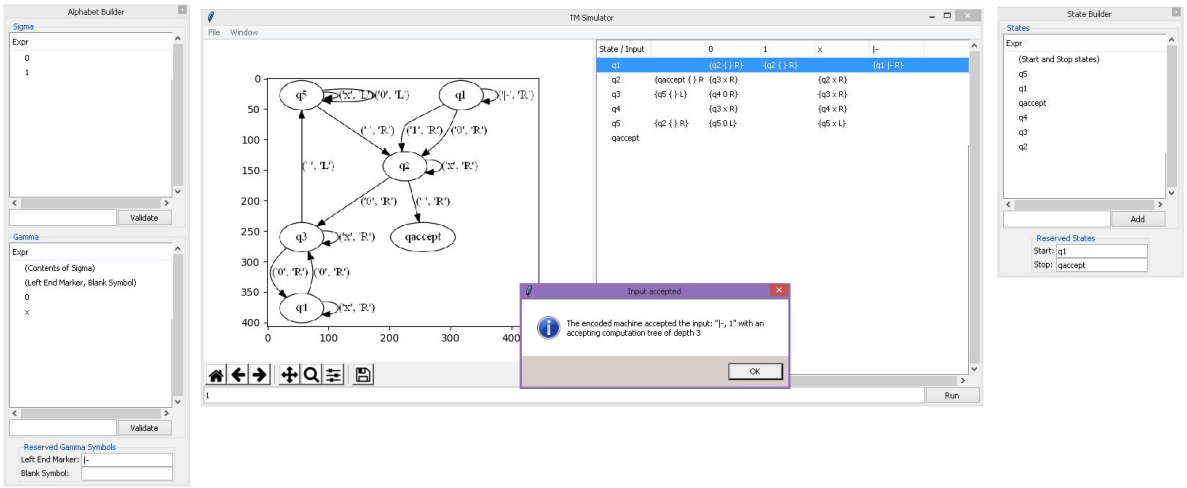

Figure 9: Successful simulation on input 1

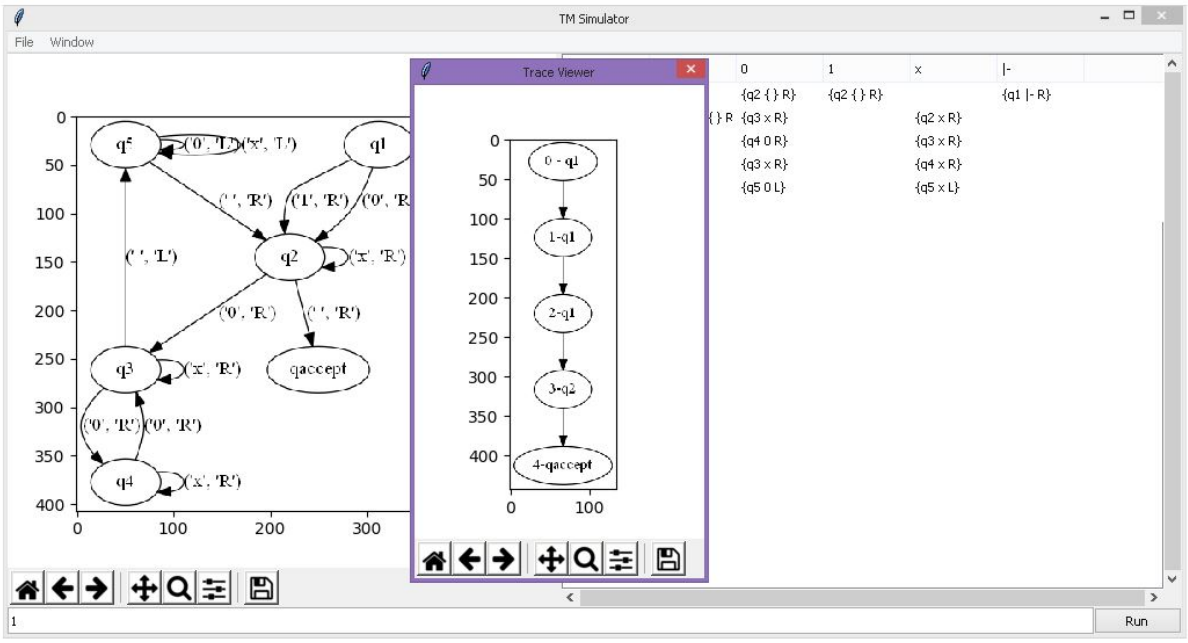

Figure 10: Trace of accepting computation

Step 5 - Alternation

Open the simulator window and resize to see the graph view using the panel slider. Click File > Import sample machine to import a sample machine to edit. After this, the simulator should look like Figure 11.

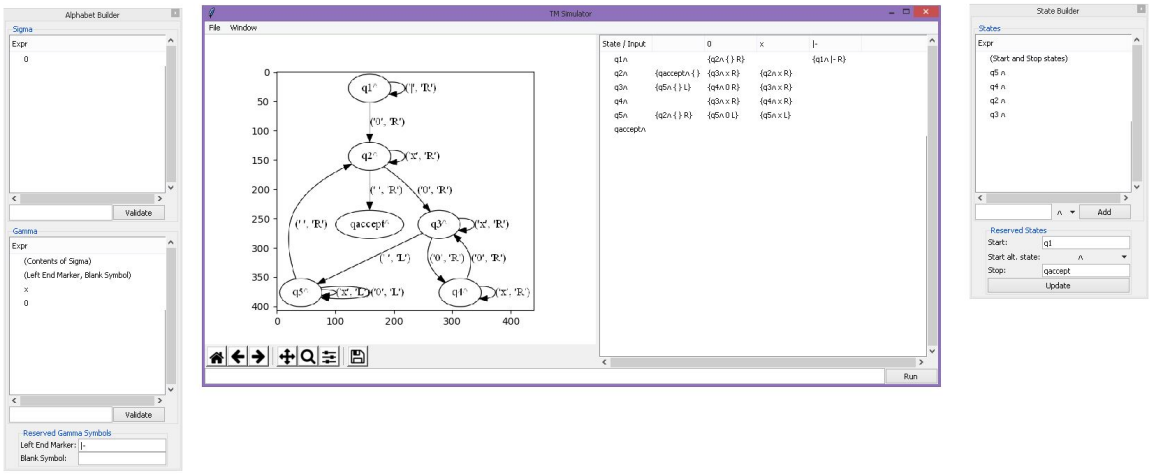

Figure 11: Starting graph view

In the state builder window, add a new state `p`, keeping the default alternation state selection (`and`). (Figure 11)

In the spreadsheet editor view, double click on the column for symbol `blank` and row for state `q1`. Add a second transition to the list, transitioning into the `p` state, writing a `blank`, and moving the head to the right. (Figure 12)

After accepting this editing, the window should look like Figure 13.

In the spreadsheet editor view, double click on the column for symbol `blank` and row for state `p`. Add a transition to the list, transitioning into the `qaccept` state, writing a `blank`, and moving the head to the right. (Figure 14)

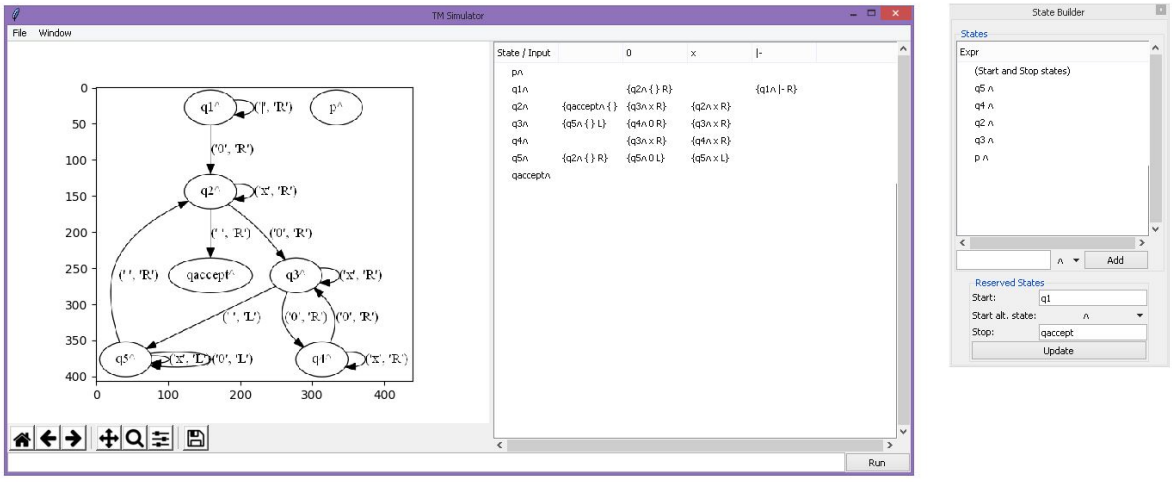

Figure 12: Adding a new and-state p

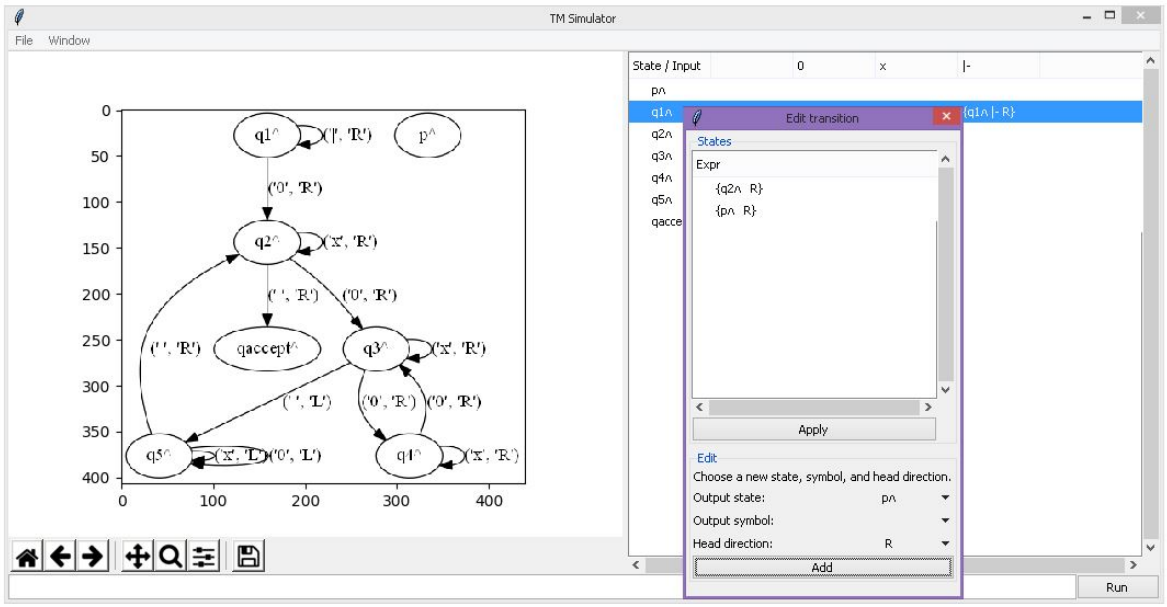

Figure 13: Editing transition into p

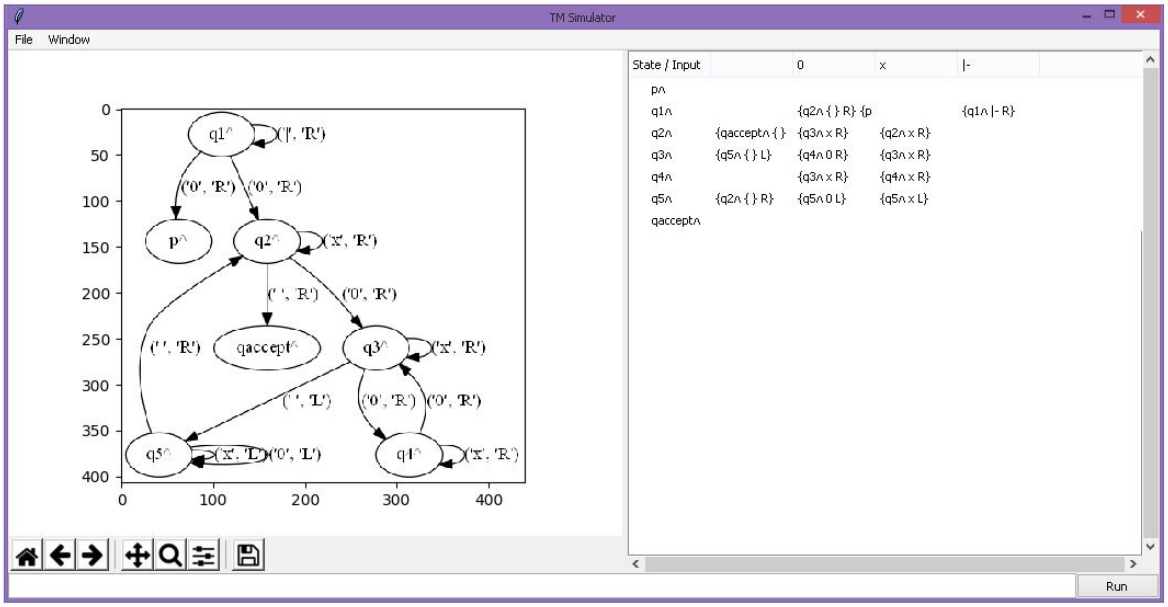

Figure 14: After editing first `p` transition

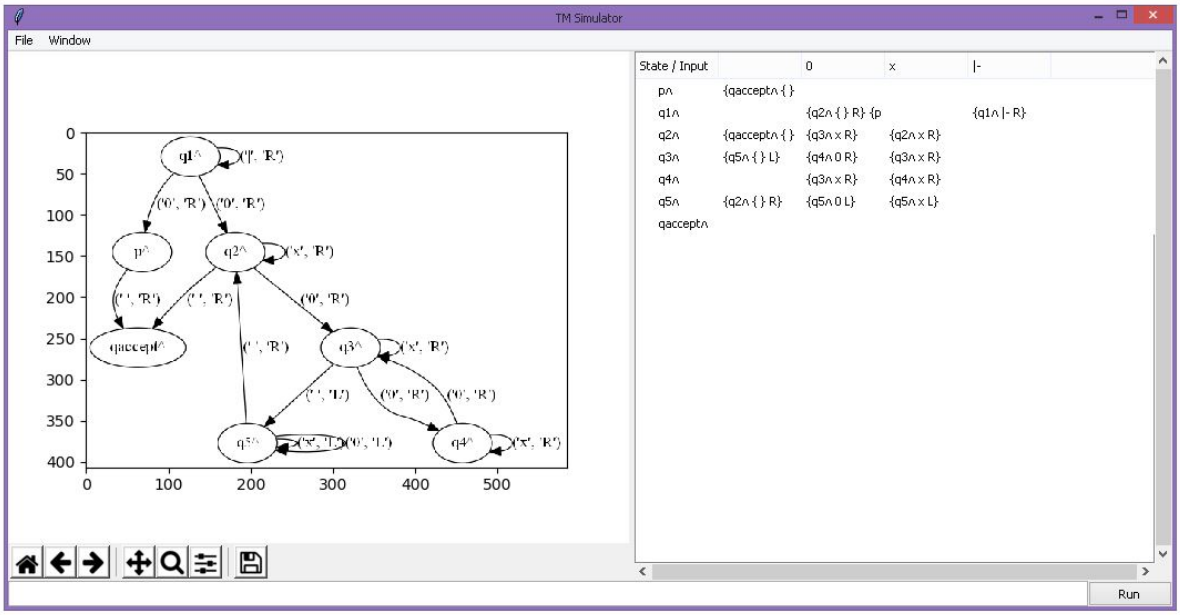

Figure 15: After editing transition out of `p`

Enter into the main simulator window's input box the string `0`. The "Run" button should be activated. Click "Run" and the machine should accept and show the accepting computation trace. (Figure 15)

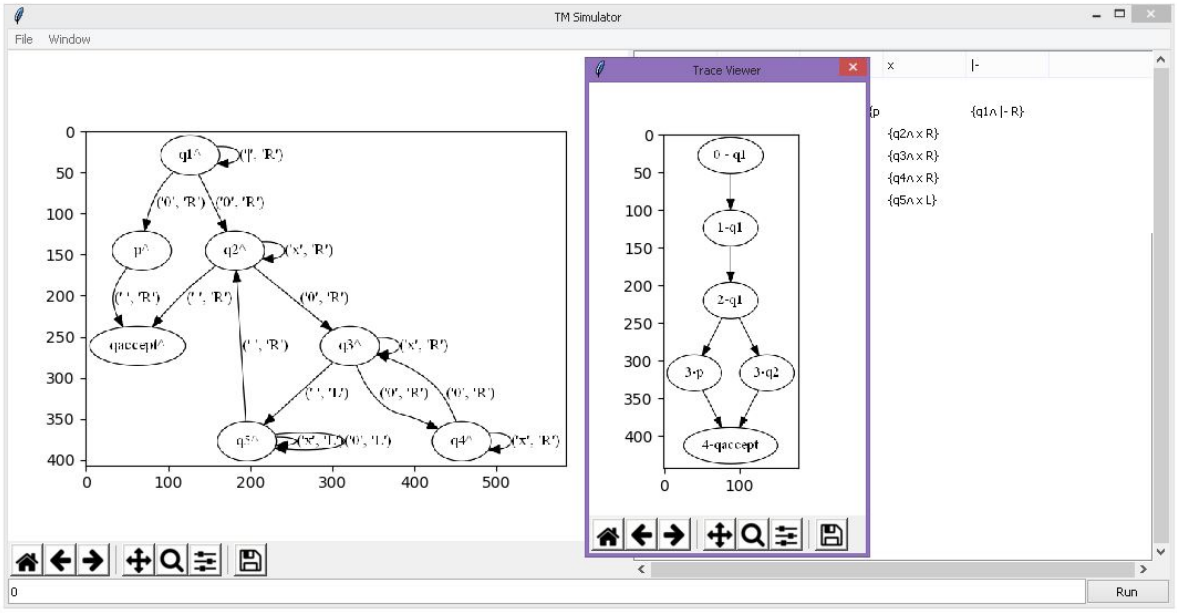

Figure 16: New accepting computation tree

Step 6 - Bounds

Open the simulator window and resize to see the graph view using the panel slider. Click File > Import sample machine to import a sample machine to edit. The time and space bound entry boxes should be default blank. Enter into the main simulator window's input box the string `0`. The "Run" button should be activated. Click "Run" and the machine should accept and show the accepting computation trace. (Figure 16)

Enter into the time bound input box the string `5`. Click "Run" and the machine should accept and show the accepting computation trace. (Figure 17)

Enter into the time bound input box the string `2`. Click "Run" and the machine should reject for exceeding the time step limit. (Figure 18)

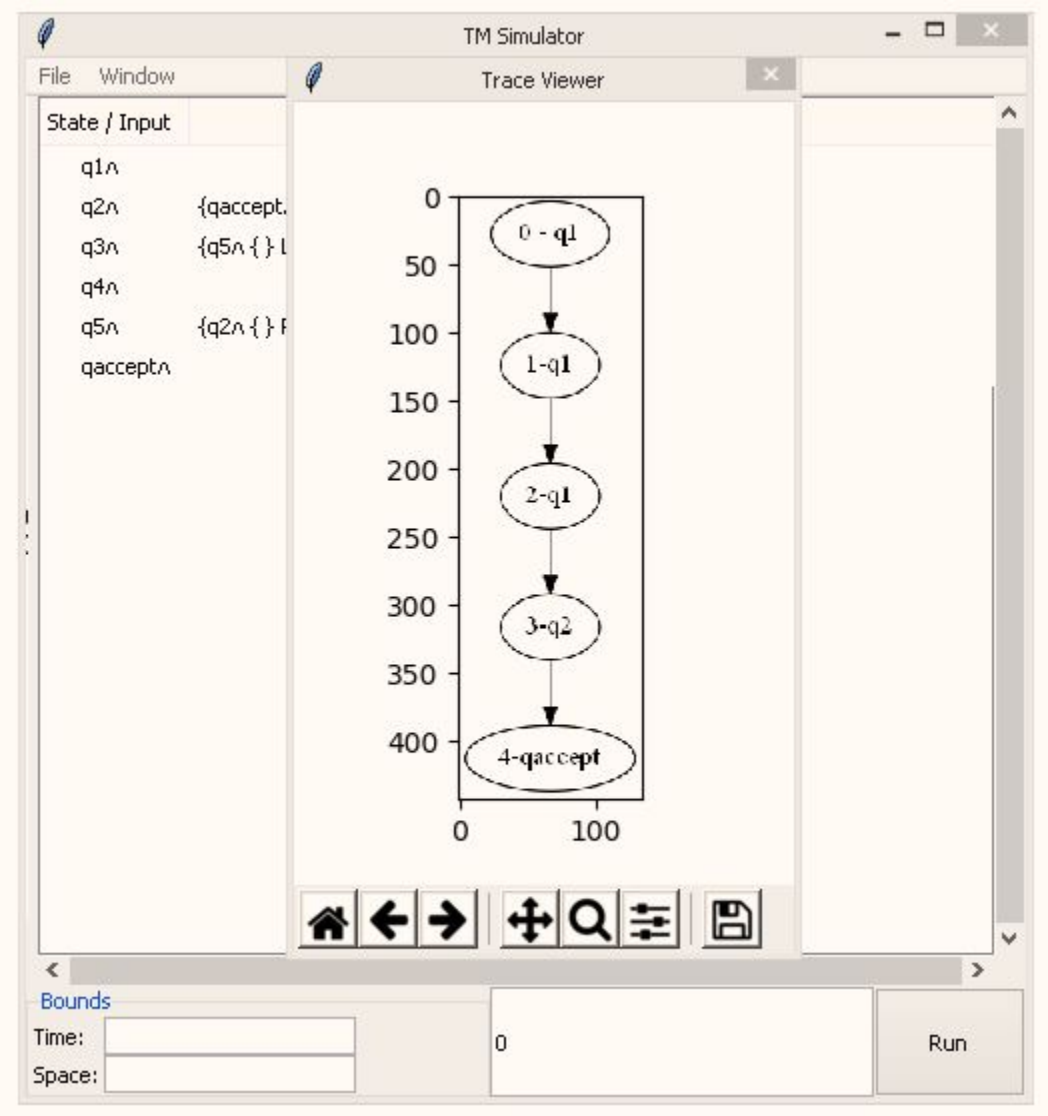

Figure 17: Unbounded computation

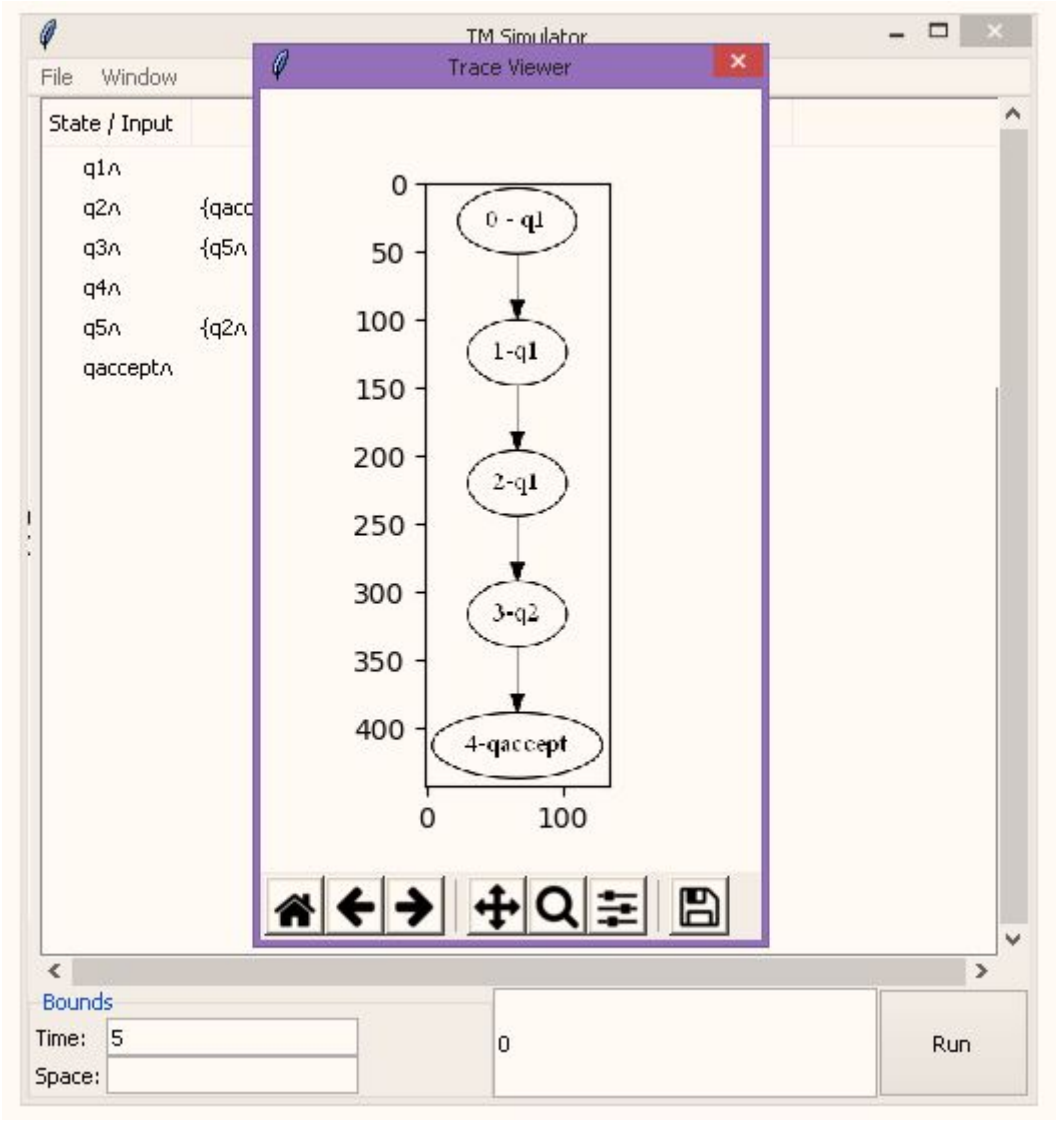

Figure 18: Bounded accepting computation

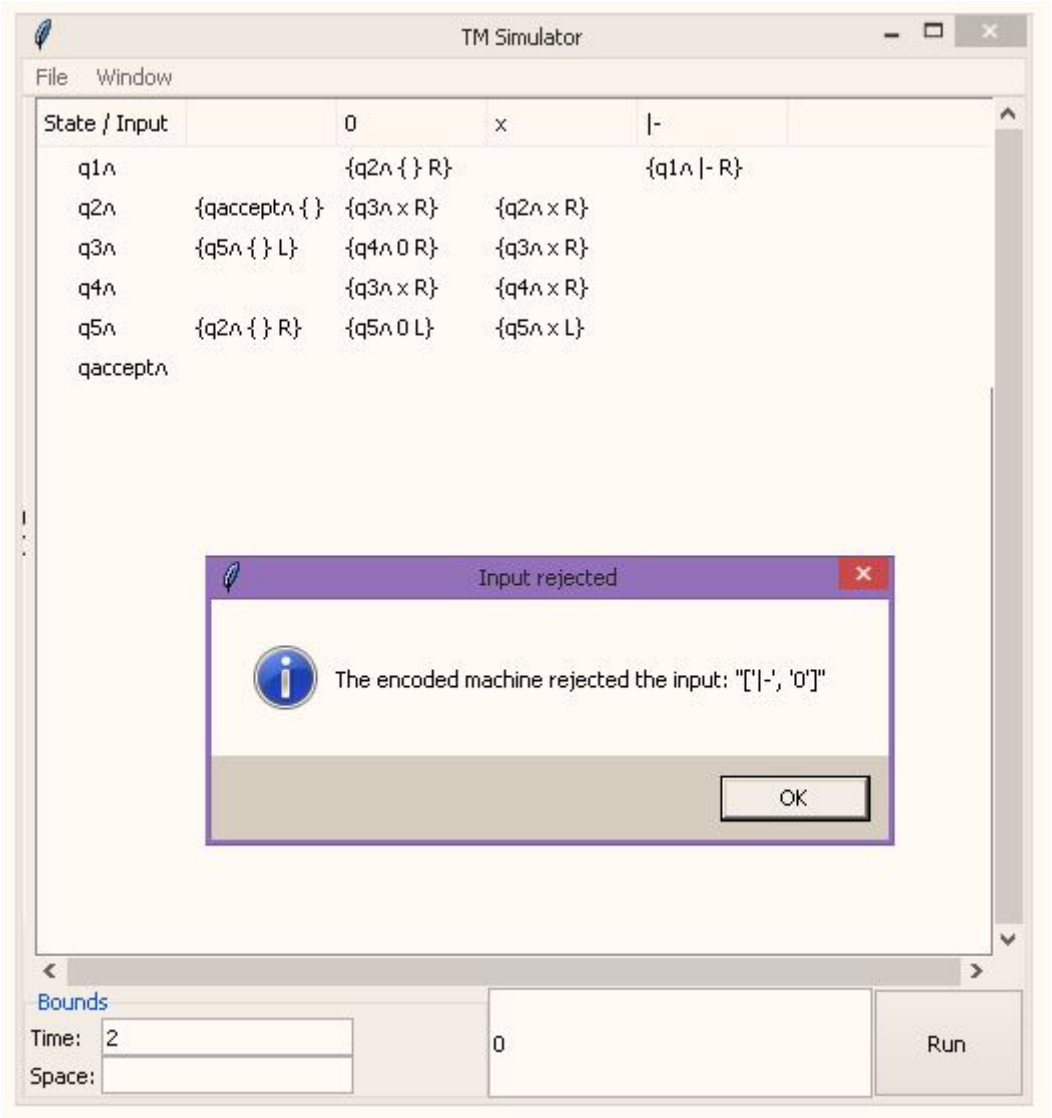

Figure 19: Bounded rejecting computation