RPI Turing Machine Software Usage Guide

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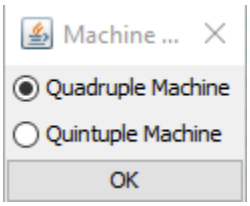
1 Starting Up:

1.1 Booting the Program

To start using the Turing Machine software, you need to run the file "TuringMacine4.jar". Alternatively, if you have a saved Turing Machine, you can alternatively drag and drop it onto "TuringMachine4.bat" or "TuringMachine4.jar".

1.2 Quadruple or Quintuple?

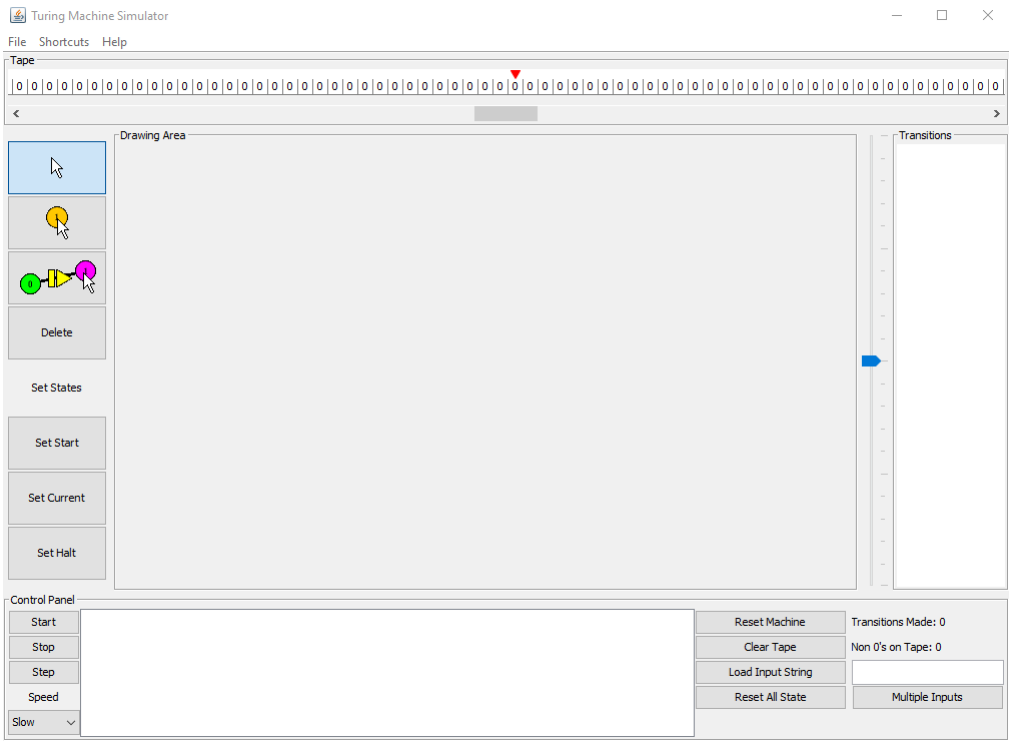
As soon as you start the program, you are presented with the following option, do you want your Turing machine to be a quadruple or quintuple machine, with the window below:



A quadruple machine will let you have the transitions be checking the current state, reading the tape, change the value on the tape or move the read head, and change states. The quintuple machine will do the same thing, except it both changes the value on the tape and moves the read head.

2 Layout and Use:

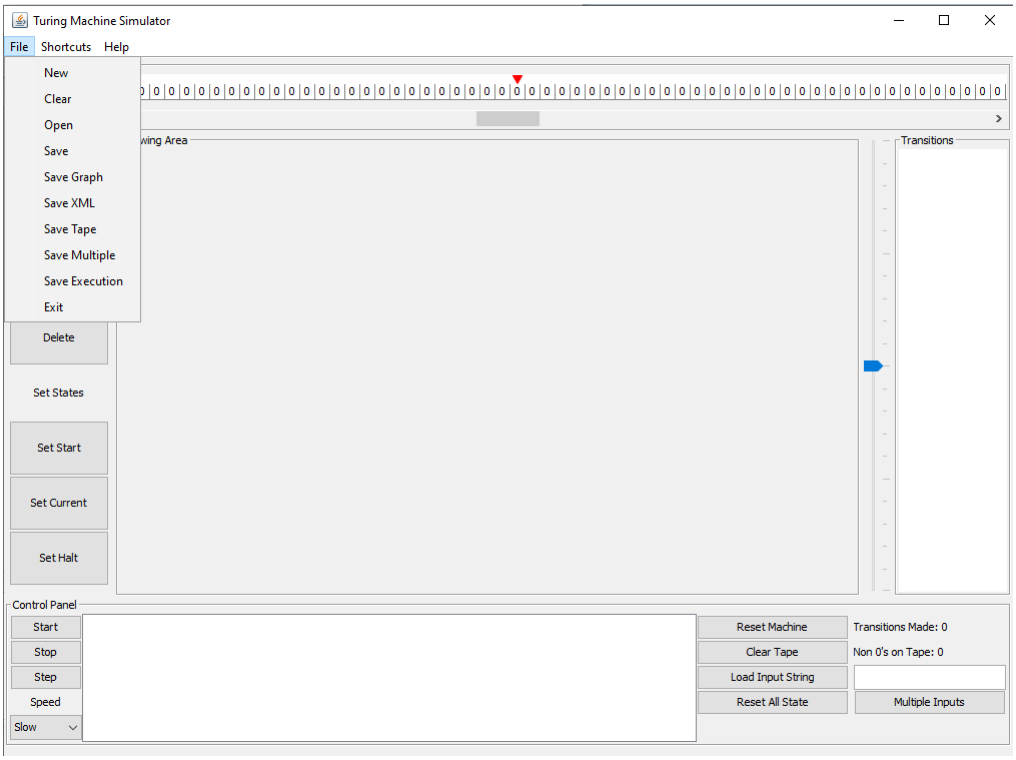
Once you choose the type of machine, you are presented with the following screen:



2.1 Menus

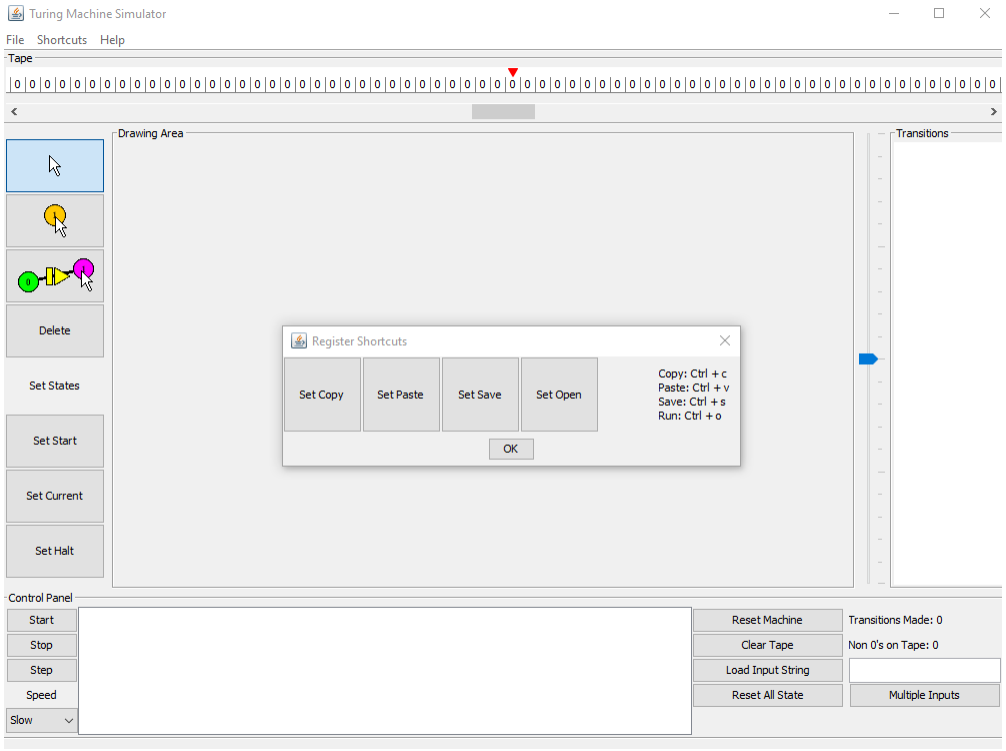
At the top left of the the screen, there are 3 menus, File, Shortcuts, and Help.

2.1.1 File



The file menu is where you go to create another Turing Machine, clear the machine you are currently working on, load a previous machine, and save your machine. Most of these operations are self explanatory, but one note is that you should use just "Save", not the other save options, since the other options save individual elements of the machine.

2.1.2 Shortcuts



This menu lets you edit and view the 4 currently implemented shortcuts, copy, paste, save, and run. They default to ctrl+c, ctrl+v, ctrl+s, and ctrl+o respectively.

2.1.3 Help

Help lets you display the about menu.

2.2 The Tape

The tape is where the Turing machine reads from and edits. The red arrow shows where the read head is currently. You can click on a cell to edit its character, but the main way to do so is to load an input string, which is located in the bottom right of the window. This allows you to type in a string of characters that will be loaded starting from the current position of the read head when the button "Load Input String" is clicked.

2.3 States and Transitions

There are 7 buttons for states and transitions which are(from top to bottom), select, add a state, add a transition, delete, set start, set current, and set halt.

2.3.1 Select

Select lets you click and move states and transitions. You can hold shift to select multiple states, and the selected states will turn orange. This allows you to copy the states with ctrl+c(may be different if you have changed the shortcut), and the program will also copy any transitions between the nodes. If you right click a state while in this mode, you will be able to edit the label of the

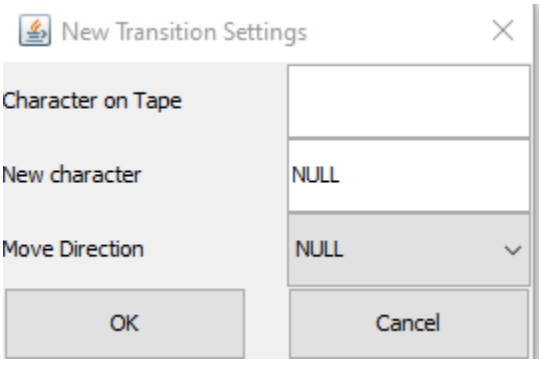
state and make it a halting state. Right clicking the drawing area outside of a state will allow you to hold and drag the current area. Moving the mouse or the slider to the right of the drawing area zooms in and out the area.

2.3.2 Add a State

By clicking this button, you can place a new state in the drawing area by clicking anywhere in it.

2.3.3 Add a Transition

To add a transition, first you click on the starting state, then the ending state, and the following window will appear:



This lets you set the conditional, if the machine will change the character, and what direction the read head will move. If it is a quadruple machine, then either new character or move direction will be NULL, while for a quintuple machine both need to have a value. This transition will then be

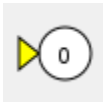
listed in the "Transitions" list on the right of the window in the standard quadruple of quintuple formalization depending on what type of machine you are using.

2.3.4 Delete

The delete button is self explanatory, allowing you to delete a transition or state. One thing to note is that if you have selected multiple states before clicking the delete button, you will delete all of those states. You can also delete a selected state by pressing the delete key on your keyboard

2.3.5 Set Start

The Set Start button lets you choose which state is the starting state, as indicated by which state has a yellow arrow pointing to it, shown below.



2.3.6 Set Current

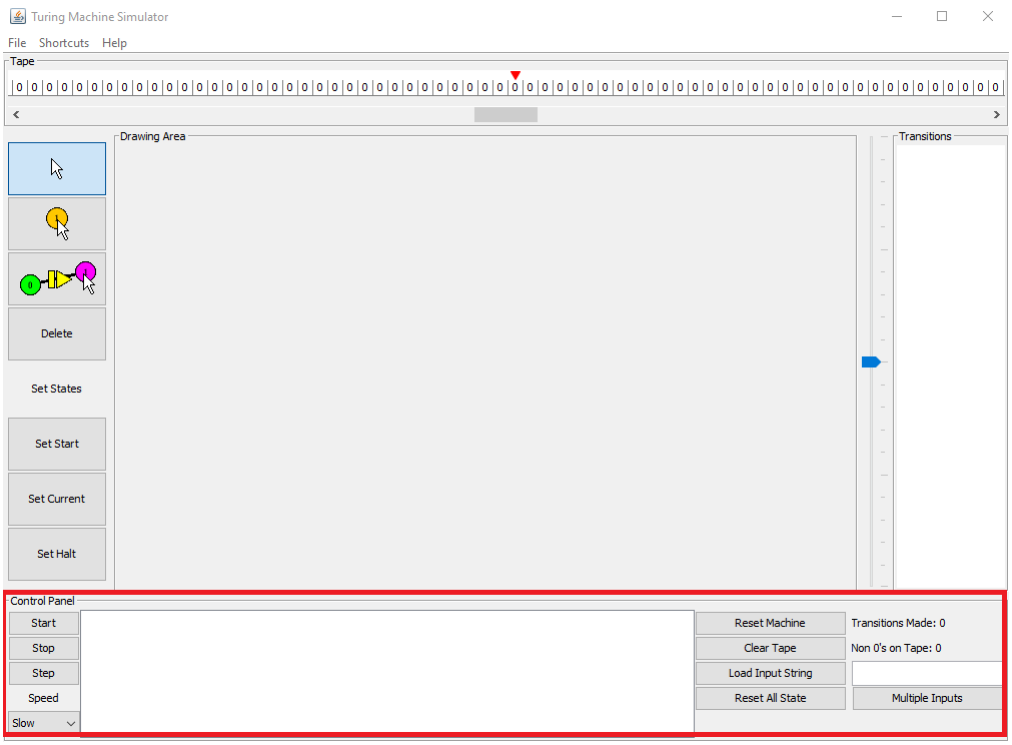
The Set Current button lets you set the current state the Turing machine is in, indicated by which state is highlighted green shown below.

2.3.7 Set Halt

The Set Halt button lets you designate a state as an explicit halting state, where if the Turing machine reaches said state, it will halt. This is indicated by having a ring inside the state shown below.

2.4 The Control Panel

The control panel has 2 sections, one with buttons related to running the machine(Start, Stop, Step, and Speed), and one related to setting up the machine(Reset Machine, Clear Tape, Load Input String, Reset All State, and Multiple Inputs) and a text box in the middle stating the operations the Turing machine is performing.



2.4.1 Start and Stop

Clicking the start button will start running the Turing machine from the current state, and will only stop when it has reached an explicit or implicit halting state, or has been stopped by hitting the stop button by the user.

2.4.2 Step

The step button has the Turing machine perform a single transition before stopping

2.4.3 Speed

The speed drop-down menu has 4 options, slow, fast, very fast, and compute, with the speed increasing as you go down the list.

2.4.4 Reset Machine

The Reset Machine button sets the current state to the starting state.

2.4.5 Clear Tape

The Clear Tape button empties the tape to be entirely the default character, '0'.

2.4.6 Load Input String

The Load Input String button loads the string from the text box next to it into the tape starting at the read head. One thing to note is that if the tape is not empty, it will not clear it, and only overwrite it with as much as the string needs to fit on the tape.

2.4.7 Reset All State

This button performs the previous 3 buttons in order, resetting the current state, clearing the tape, and loading the input string in.

2.4.8 Multiple Inputs

This button allows you to let the machine run on compute for multiple inputs, then give the resulting tape and number of transitions.

3 Examples

3.1 Unary Adder