

# Turing Machine Documentation

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## 1 Roles

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## 2 Definition

A Turing machine is meant to make a stack and queue depending on the input. It's meant to be a visualization tool for CS 202 students studying these data structures. This is a really good visualization tool, as the program used to build the Turing Machine provides the overhead for the visualization.

## 3 States and Transitions

The Turing machine operates by moving between states and performing transitions on the tape. The states and transitions are labelled as follows:

- *Red* are all the reject states ( $q_{reject}$ )
- *Green* are all the accept states ( $q_{accept}$ )
- *Blue* is the Queue's add States
- *Yellow* is the Queue's remove States (1st part: *deletion*)
- *Orange* is the Queue's remove States (2nd part: *movement*)
- *Magenta* is the Stack with the add states
- *Cyan* is the Stack with the remove states
- *Black* are the initial states to set up the #

The transitions can be summarized as follows:

- xxxxxx
- xxxxxx

## 4 Image

## 5 Instructions

A's mean to add the next character and D's mean to delete from the top or the bottom, depending on whether you specified a stack or a queue by either inputting an S or Q at the beginning of the string. You can add a,b,c, or d. This can, of course, be implemented with any character, but using only 4 characters makes it easier to visualize the states.

## 6 Examples

Here are some examples of input and output for the Turing machine:

- Input: SAaAbD, Output: xxxxxx#a
- Input: SAaAbAcDAdAaDD, Output: xxxxxxxxxxxxxx#ab
- Input: QAaAbD, Output: xxxxxx#b
- Input: QAaAbAcDAdAaDD, Output: xxxxxxxxxxxxxx#da
- Input: QA#AbD, Output: INVALID
- Input: QA1A2D, Output: INVALID

## 7 Conclusion

The Turing machine is a powerful tool for performing computations on input tapes. It has applications in computer science, mathematics, and other fields.