CENG 280 - HOMEWORK 3

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June 13, 2022

Question 1

q0 is the initial state.Since,the language accepts only 0 as the beginning of the string,after reading 0,0 is changed to A and proceeds to new state q1.After reading 0,until reading a 1 ,it does not move to a new state.After reading 1,the tape has to put it to stack and that means moving to a new state q2.Additionally,in order to go to accept state,consecutive 1s that is labeled by B,has to be revisited to keep the equal number of 0s and 1s.So q3 state is added.Finally after achieving equal number of 0s followed by equal number of 1s,the string is accepted.Also,only blank string can not be accepted since N bigger than 0.

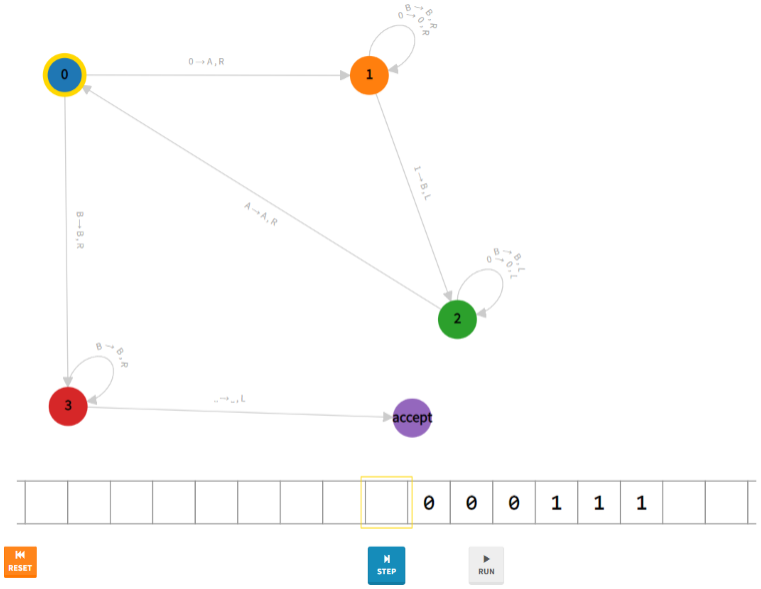

Figure 1: the turing machine

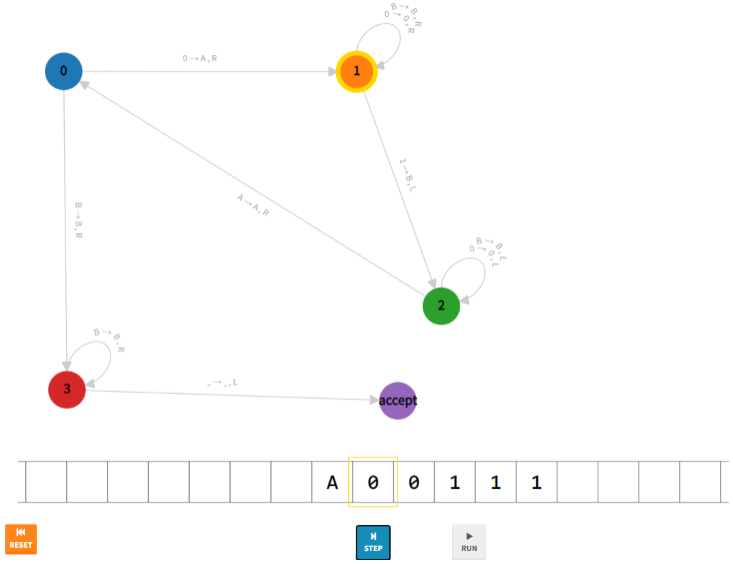

Figure 2: initial state of 000111

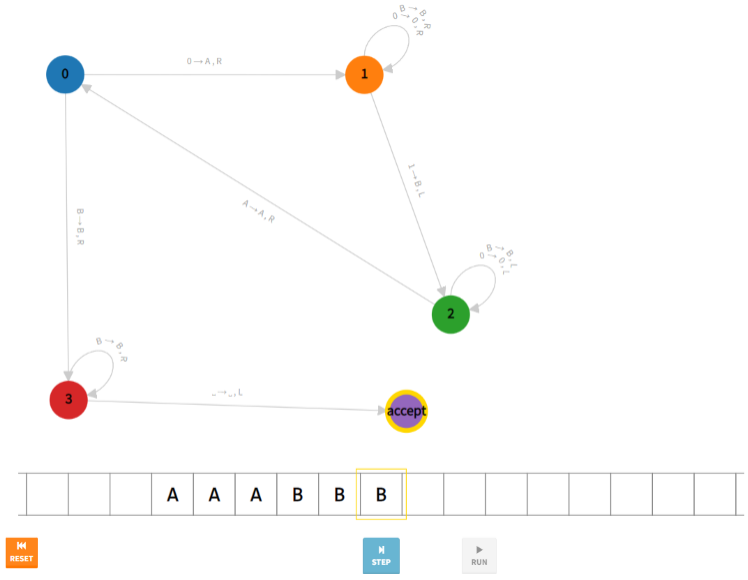

Figure 3: end state of 000111

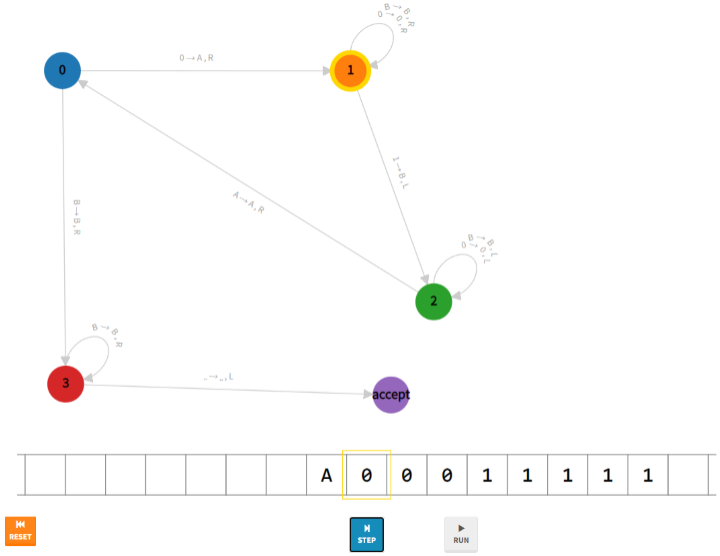

Figure 4: initial state of 000011111

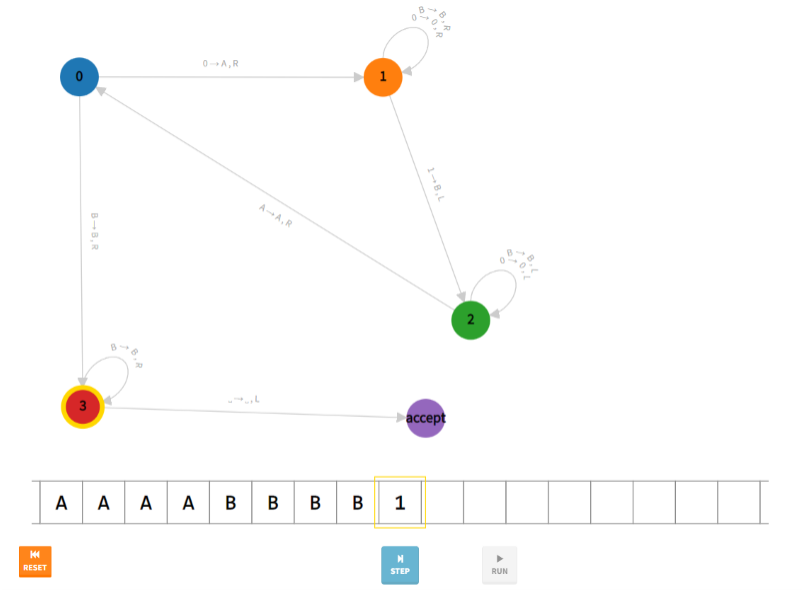

Figure 5: end state of 000011111

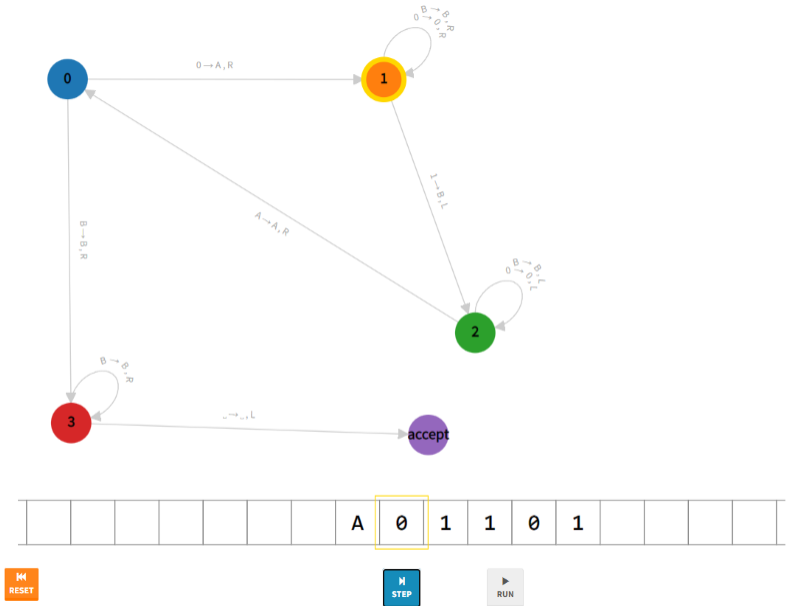

Figure 6: initial state of 001101

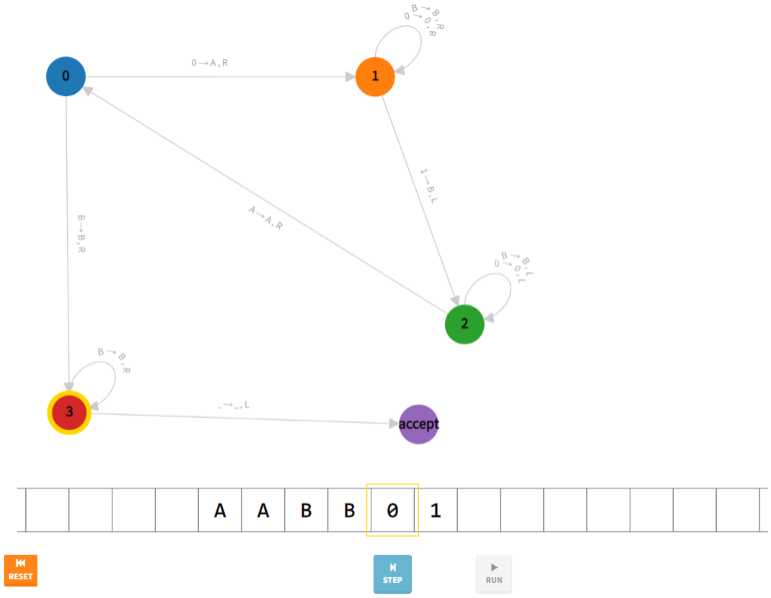

Figure 7: end state of 001101

1 Question 2

a)

q0 is the initial state.If string starts with 0 state q1,otherwise state q4 is followed.After reading 0 or 1 ,it is labeled with X and Y and followed by q1 and q4.If X or Y is read ,there needs to be a new state ,which is q3 and q6, so that the machine puts in the stack in other words,remembers.After labeling,the tape must go right and finishes counting the matching X,Ys with 0,1s hence state q7 is needed.If the match is complete it is accepted.

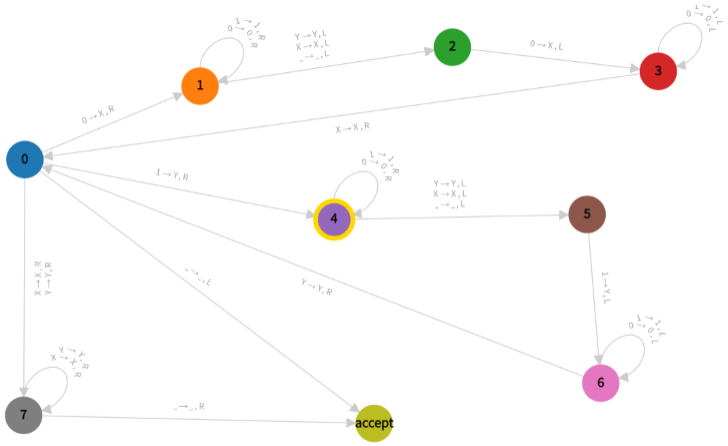

Figure 8: the turing machine

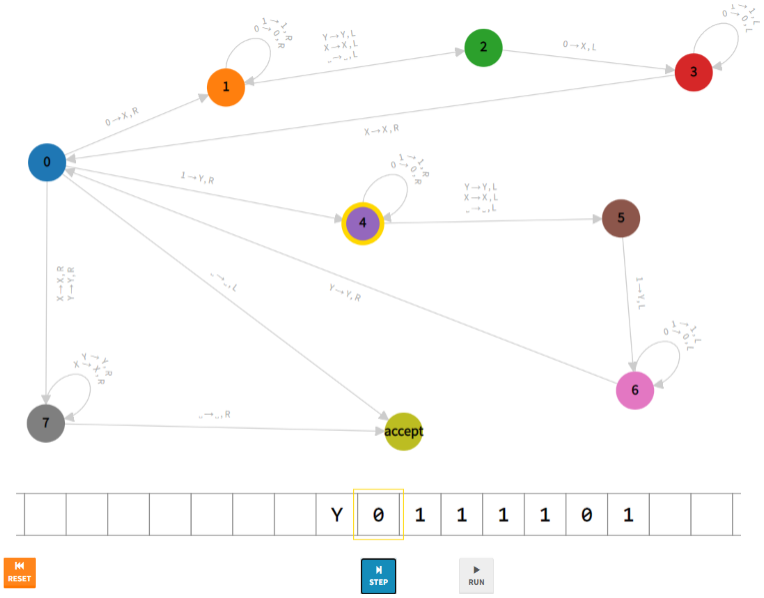

Figure 9: initial state of 1011 for q2

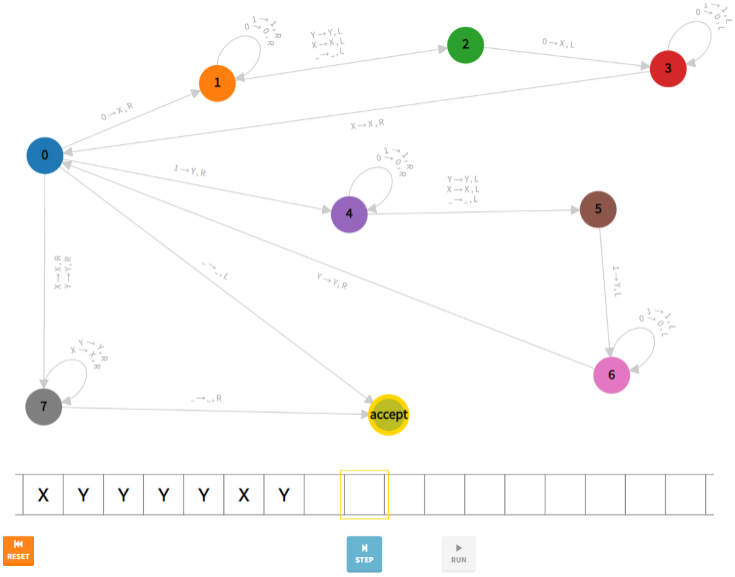

Figure 10: end state of 1011 for q2

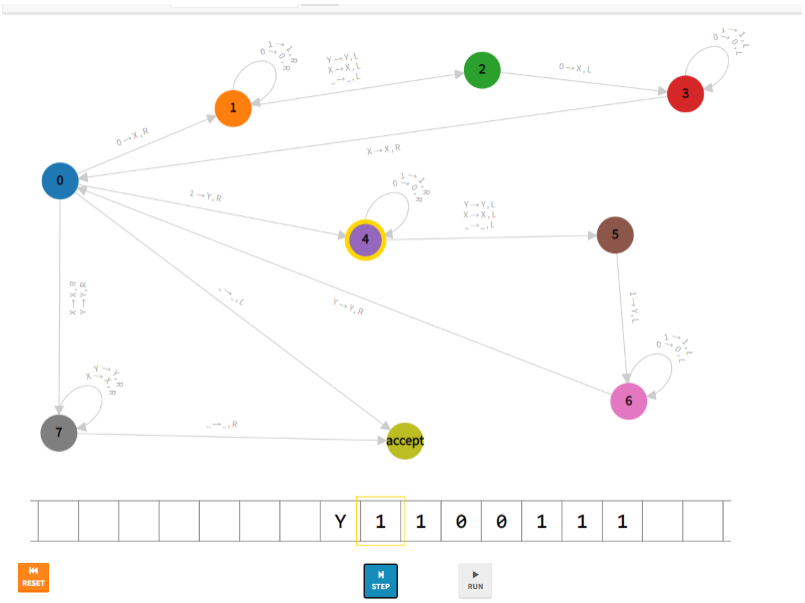

Figure 11: initial state of 1110 for q2

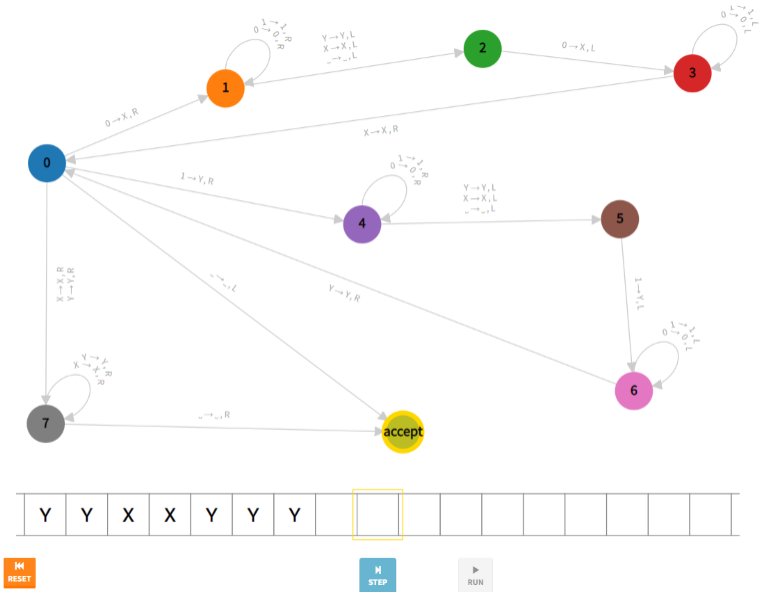

Figure 12: end state of 1110 for q2

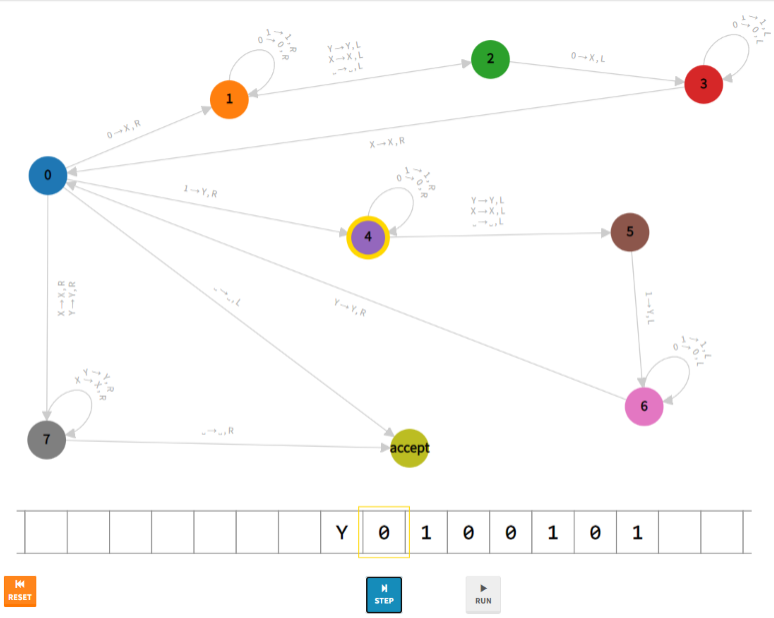

Figure 13: initial state of 1010 for q2

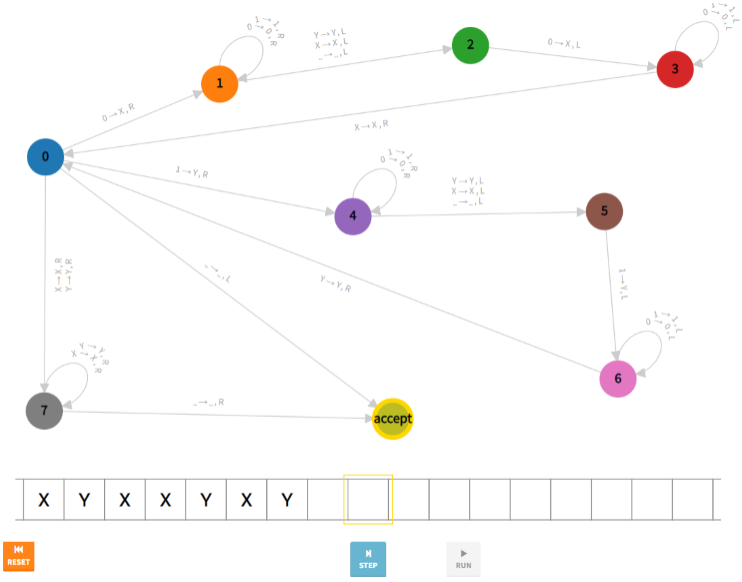

Figure 14: end state of 1010 for q2

Question 3

A two dimensional Turing Machine is

$$M = (Q.q_0, U, F, \sum, \Gamma, \delta)$$

where Q is a finite set of states,

$$q_0$$

is the initial state, U is the set of universal states, F is the set of accepting(final) states,

$$\sum$$

is a finite input alphabet

$$\Gamma$$

is a finite storage tape alphabet ,

$$\delta : Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R, U, D\}$$

is the move relation where L=left,R=right,U=up,D=down direction in 2d tape.The tape has the top end and the left end but extends indefinitely to the right and down.