CSE 355: Intro to Theoretical Computer Science

Recitation #12 (20 pts)

1. [10 pts] Let M be the Turing machine defined by the following transition function δ. Assume there is a mark *B* placed at the left end of the tape. $\Sigma = \{a, b, c\}$, $\Gamma = \{a, b, c, B\}$

δ	*B*	*a*	*b*	*c*
q0	q_1, B, R			
q1	q_2, B, L	q_1, a, R	q_1, c, R	q_1, c, R
q2	q_3, B, R	q_2, c, L		q_2, b, L
q3				

1.1) Trace the configuration for the input string *aabca.*

Since there is a B at the left end so the string on the tape will be "Baabca". Let U = blank

(it only mentioned that it is marked but does not specify B, thus, I show both cases)

If B = symbol

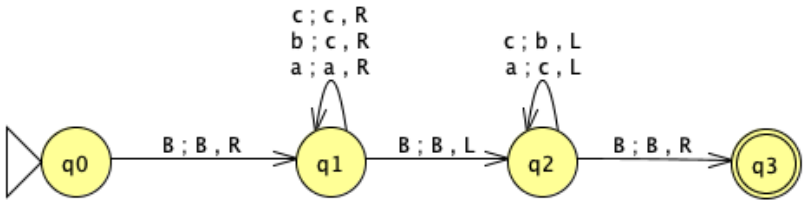
$q_0Baabca \rightarrow Bq_1aabca \rightarrow Baq_1abca \rightarrow Baaq_1bca \rightarrow Baacq_1ca \rightarrow Baaccq_1a \rightarrow Baaccaq_1U$

If B = blank

$q_0Baabca \rightarrow Bq_1aabca \rightarrow Baq_1abca \rightarrow Baaq_1bca \rightarrow Baacq_1ca \rightarrow Baaccq_1a \rightarrow Baaccaq_1B \rightarrow$

$Baaccq_2a \rightarrow Baacq_2cc \rightarrow Baaq_2cbc \rightarrow Baq_2abbc \rightarrow Bq_2acbbc \rightarrow q_2Bccbbc \rightarrow Bq_3ccbbc$

1.2) Use JFLAP to draw the state diagram of the Turing machine.



1.3) Describe in English the result of the computation of M (*i.e.* what M does?)

If B = symbol

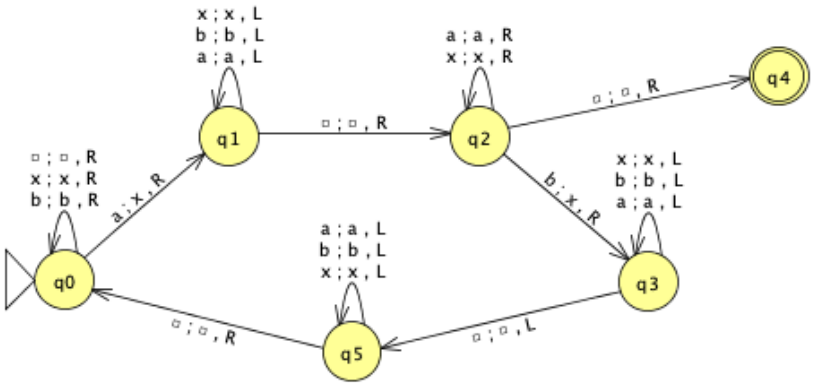
The machine will allow input that contains two B symbols otherwise it will be rejected.

If B = blank

The machine will convert a → c and c → b from the original string. Which would also leave c and b on the tape.

2. [10 pts] Use JFLAP to draw the state diagram of a Turing machine that recognizes the following language.

$$L = \{\omega \in \{a, b\}^* \mid \omega \text{ contains more as than bs}\}$$


x ; x , L
b ; b , L
a ; a , L
a ; a , R
x ; x , R
q4
q1
q2
▫ ; ▫ , R
▫ ; ▫ , R
▫ ; ▫ , R
x ; x , L
b ; b , L
a ; a , L
a ; x , R
b ; x , R
q0
q3
a ; a , L
b ; b , L
x ; x , L
▫ ; ▫ , R
▫ ; ▫ , L
q5