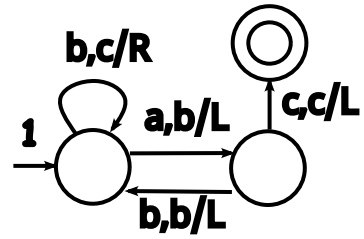
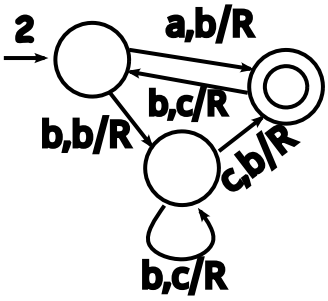
COMPSCI 3331 - Fall 2022 - Quiz 8

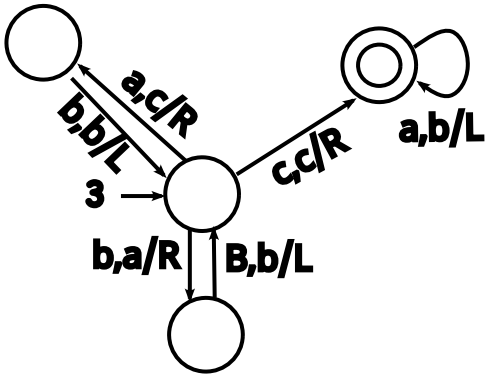
Name									
Student Number									

In both questions, $\Sigma = \{a, b, c\}$ and $\Gamma = \{a, b, c, B\}$ where B is the blank symbol.
(1.5 marks) 1. For each of the words in the table, write **one** number from 1 to 3 to show which TM accepts that word. If **no** TM accepts the word, write X in the box.



aa	
ba	
b	

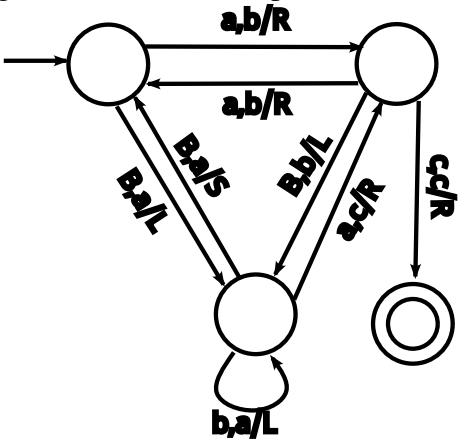




Solution: *aa* is 2, *ba* is 1 and *b* is 3.

To see that *b* is accepted by TM 3, note that at first the machine will replace *b* with *ab* and return to the start state (via the bottom state) with the head at the beginning of the string. Then the machine will replace *ab* with *cb* and return to the start state (via the left state) with the head at the beginning of the string. Finally, the machine will move to the final state.

(1 mark) 2. Consider the TM below. Write a (finite) word in the box on the right that makes the TM go into an infinite loop when run on that word as input.



Answer here:
aa

Solution: any word from $(aa)^*$ will cause the machine to go into an infinite loop.

On aa, the machine replaces all a's with b's and then sees a blank. The machine will then go to the bottom state (adding an a in the process) and then replace all b's with a's. Then the machine will return to the start state with a^4 on the tape. At this point, it repeats the process (replace a's with b's, move to bottom state, replace b's with a's and then end up in the start state again). Again, two more a's are added to the tape.

Any word in $(aa)^*$ will cause this machine to go into an infinite loop in this way.

For a, the machine will replace a with bb and move to the bottom state. Then the machine will end up with aab on its tape in the initial state, with the head pointing at the first a. Moving back and forth between the top two states and moving right, the machine will be in the start state with bbb on the tape but pointing at the last b. But as there is no tranision from the start state on b, at this point the machine crashes. This happens also with aaa.

Note that the input alphabet is a, b so that B cannot be a symbol in the interior of an input word.