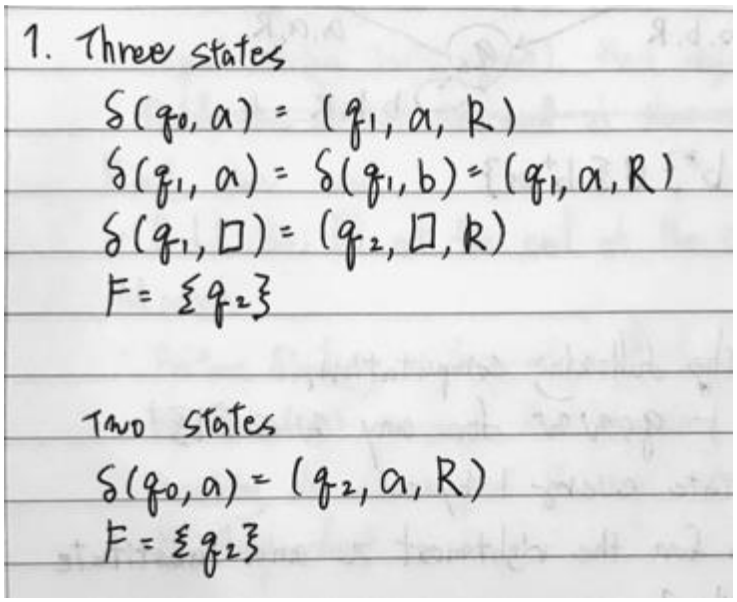
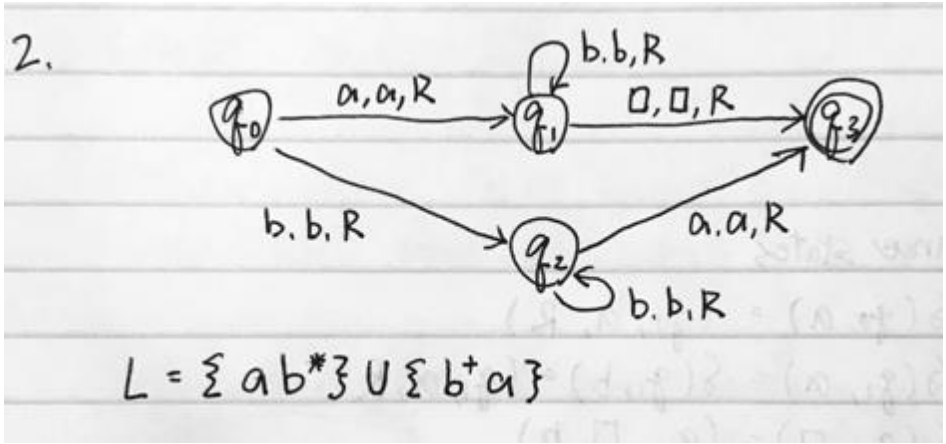
MET CS662 - Assignment #8

1. Design a Turing Machine with no more than three states that accepts the language $L(a(a + b)^*)$. Assume that $\sum = \{a, b\}$. Is it possible to do this with a two-state machine?

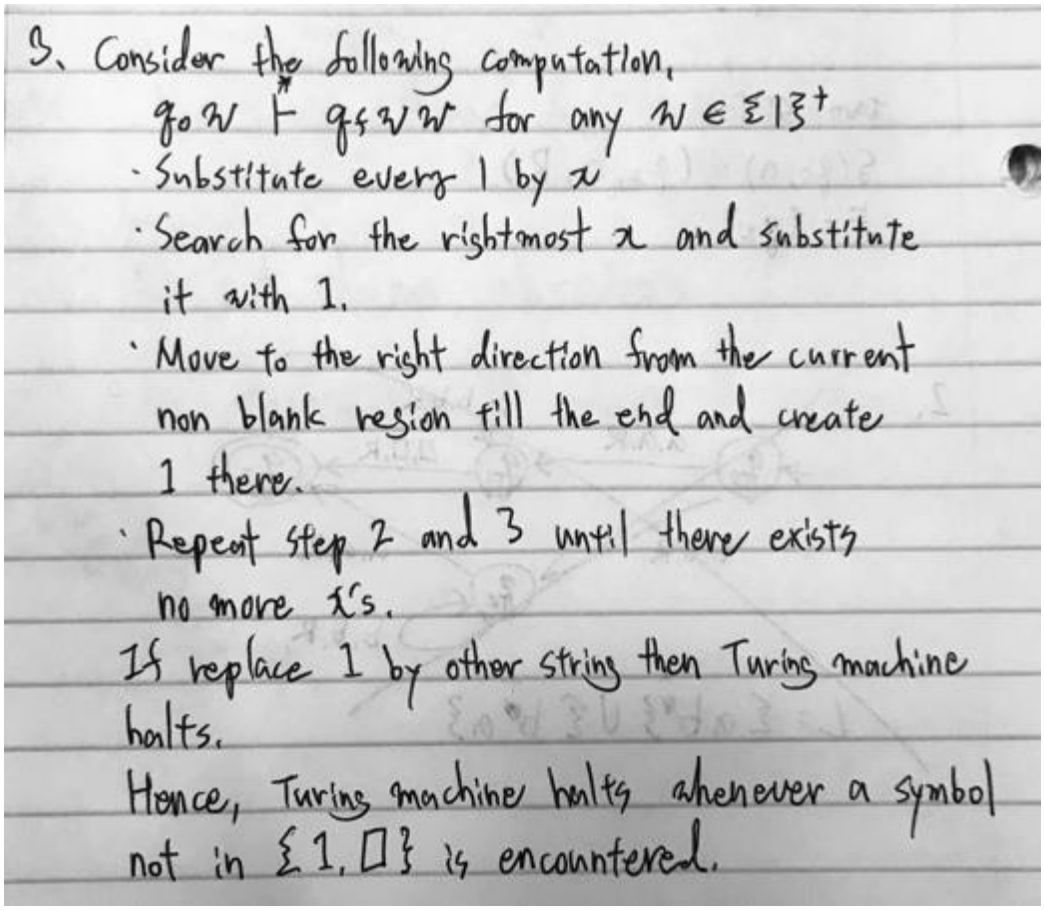


2. What language is accepted by the *TM*, $M = (\{q_0, q_1, q_2, q_3\}, \{a, b\}, \{a, b, \square\}, \delta, q_0, \square, \{q_3\})$ with

$\delta(q_0, a) = (q_1, a, R)$ $\quad$ $\delta(q_1, \square) = (q_3, \square, R)$
$\delta(q_0, b) = (q_2, b, R)$ $\quad$ $\delta(q_2, b) = (q_2, b, R)$
$\delta(q_1, b) = (q_1, b, R)$ $\quad$ $\delta(q_2, a) = (q_3, a, R)$



3. What happens in Example 9.10 (in the textbook where the TM copies strings of 1's, i.e. the TM that performs $q_0\ \omega \vdash^* q_f\omega\omega$) if the string ω contains any symbol other than 1?



3. Consider the following computation,
$q_0 w \vdash^* q_f w w$ for any $w \in \Sigma|\Sigma^+$
- Substitute every 1 by x
- Search for the rightmost x and substitute it with 1.
- Move to the right direction from the current non blank region till the end and create 1 there.
- Repeat step 2 and 3 until there exists no more x's.

If replace 1 by other string then Turing machine halts.
Hence, Turing machine halts whenever a symbol not in $\{1, \square\}$ is encountered.

4. Outline with enough details a TM that accepts the language $L = \{\omega\omega\ |\omega \in \{a, b\}^+\}$.

4. Find the midpoint
   - Find the midpoint and mark it. If there's a lone character in the middle (i.e. the length of the input string isn't even), then reject immediately.
   - ~~Add the # at the end of the string.~~

Find the end
- Add the □ at the end of the string

Match
- After finding mid-point and found the beginning of the first w and the beginning of the 2nd word, marking off characters if they match and rejecting if they don't.