1. Find all strings in $L((a+b)b(a+ab)^*)$ of length less than four.

length 0 = Not possible

length 1 = Not possible

length 2 = ab, bb

length 3 = aba, bba

$\therefore$ {ab, bb, aba, bba}

4. Find a regular expression for the set $\{a^n b^m : n \geq 3, m \text{ is even}\}$.

$aaa(a^*)(bb)^*$

5. Find a regular expression for the set $\{a^n b^m : (n+m) \text{ is even}\}$.

There are 2 cases:

i) Both n and m are even

$(aa)^* (bb)^*$

(aa)*(bb)* + a(aa)*b(bb)*

ii) Both n and m are odd

$a(aa)^* b(bb)^*$

$\therefore$ The regular expression is the combination of both cases

5) Find a regular expression for the set $\{a^n b^m: (n+m)$ *is even*$\}$.

n+m is even, which implicits n and m are odd or even at the same time

when both odd, we have $L(a(aa)^*b(bb)^*) = L((aa)^*ab(bb)^*)$

when both even, we have $L((aa)^*(bb)^*)$

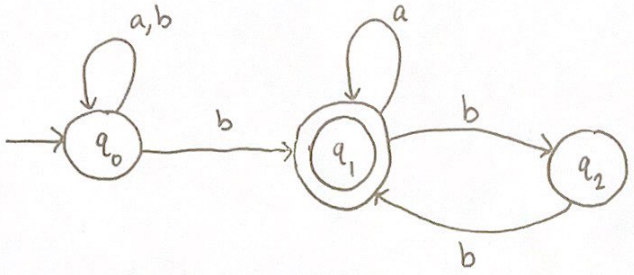
so final RE is $L((aa)^*ab(bb)^*) \cup L((aa)^*(bb)^*)$

$= L((aa)^*ab(bb)^* + (aa)^*(lambda)(bb)^*)$

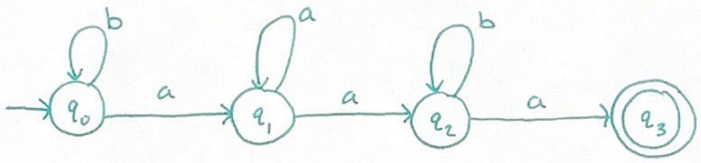
$= L((aa)^*(ab+\lambda)(bb)^*)$ ~~or $L((aa)^*(ab)^*(bb)^*)$~~

3. Give an nfa that accepts the language $L((a+b)^*b(a+bb)^*)$.

$(a+b)^*$ includes λ
$(a+bb)^*$ includes λ



10a. Find regular expressions for the languages accepted by the following automata.



q_0: contains a self-loop on the input string b having length zero or more. Moves to q_1 on the input symbol a

q_1: contains a self-loop and outgoing edge on the input symbol a

q_2: contains a self-loop on the input string b having length zero or more. Moves to q_3, a final state, on the input string a

$\therefore$ the regular expression for this automata is $b^*aa^*ab^*a$

3.2 #10(a)

FA:

RE: $b^*aa^*ab^*a$

RG:

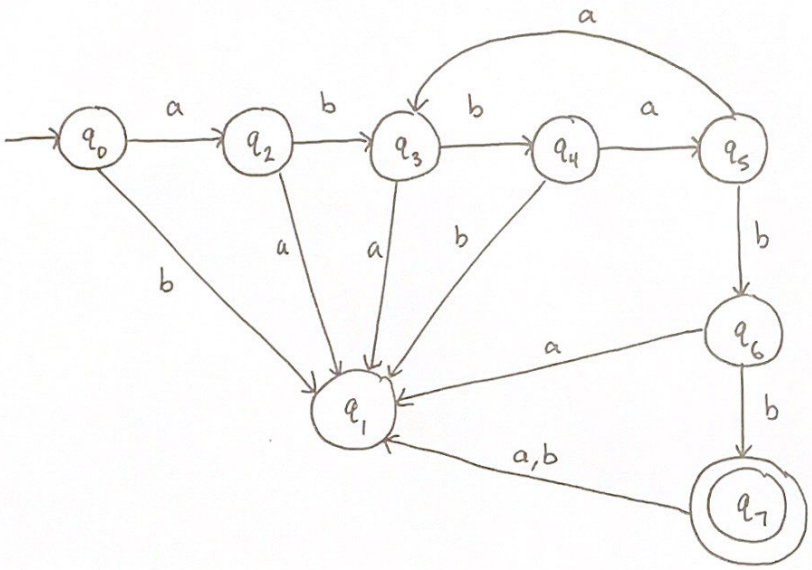
$S \longrightarrow bS \mid aA$
$A \longrightarrow aA \mid aB$
$B \longrightarrow bB \mid a$

1. Construct a dfa that accepts the language generated by the grammar

$S \rightarrow abA,$

$A \rightarrow baB,$

$B \rightarrow aA \mid bb$



2. Find a regular grammar that generates the language $L(aa^*(ab+a)^*)$.

A grammar $G = (V, T, S, P)$

where $V = \{S, A, B\}$

$T = \{a, b\}$

RG:

$$S \longrightarrow bS \mid aA$$
$$A \longrightarrow aA \mid aB$$
$$B \longrightarrow bB \mid a$$

Test Strin

$S \to aA \to aaA \to aaaA \to aaaaB \to aaaabA \to aaaababB$

$\to aaaababA \longrightarrow aaaababaA \longrightarrow aaaababa$

3.3 #2 RE $aa^*(ab+\lambda)^*$

FA