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

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

ii) Both n and m are odd

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

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

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

Note: Alternative Form

$a(aa)^* b(bb)^* \Rightarrow (aa)^* ab(bb)^*$

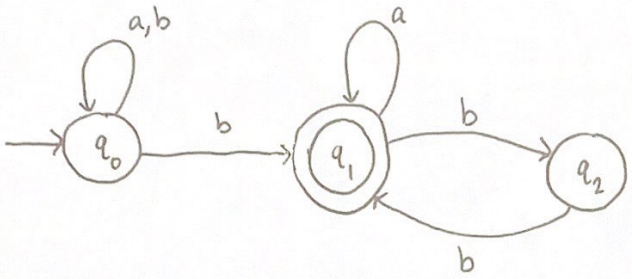
$(aa)^* ab(bb)^* + (aa)^* (bb)^*$

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

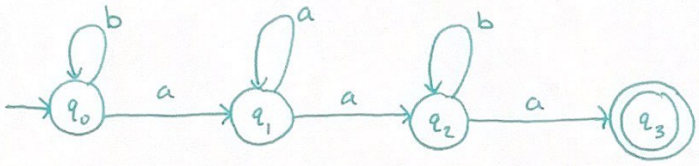
$= (aa)^* (ab + \lambda)(bb)^*$

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

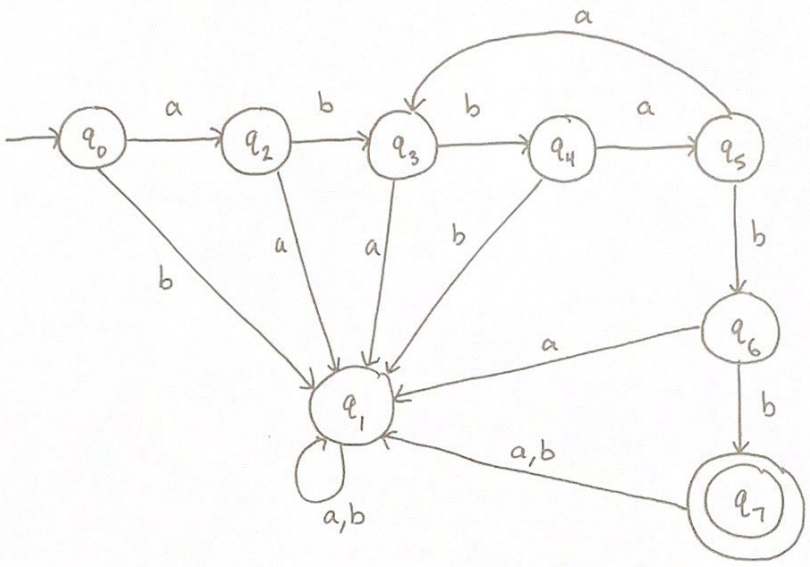
$\therefore$ the regular expression for this automata is $b^*aa^*ab^*a$

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

$T = \{a, b\}$

$P = \{ S \to aA,$

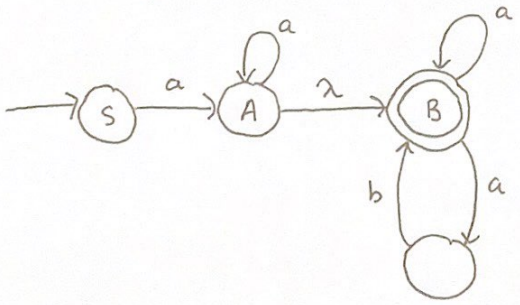
$A \to aA \mid B$

$B \to abB \mid aB \mid \lambda \}$

Test String: ~~aaaababa~~

~~$S \Rightarrow aA \Rightarrow aaA \Rightarrow aaaA \Rightarrow aaaB \Rightarrow aaaabB \Rightarrow aaaababB \Rightarrow aaaababA \Rightarrow aaaababaA \Rightarrow aaaababa$~~

NFA Diagram:



Note:

dfa or nfa diagram

$(a+b)^*$

Regular Expression

$S \to aS \mid bS \mid \lambda$

Regular Grammar