

The answers must be the original work of the author. While discussion with others is permitted and encouraged, the final work should be done individually. You are not allowed to work in groups. You are allowed to build on the material supplied in the class. Any other source must be specified clearly.

1. (15+15+20 points) Consider the following language over $\Sigma = \{a, b\}$:

$L = \{x \mid x \in \Sigma^* \text{ and}$
 there are 'a's (if any) before and after 'b's (if any) in x ,
 the number of 'b's the same as the total number of 'a's}

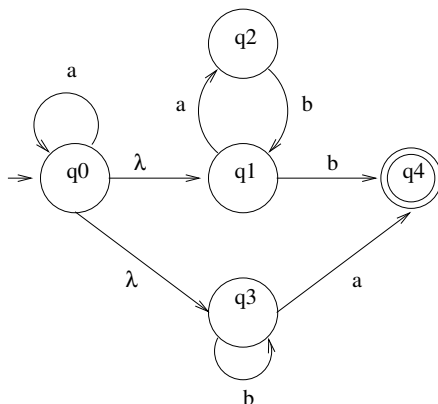
$$= \{a^m b^i a^n \mid i = m + n \text{ and } i, m, n \geq 0\}$$

(a) Write the first 5 elements of L starting with the shortest string. Ordering among same length strings doesn't matter.

(b) Give a recursive definition of L . Provide the **basis** and the **recursive step** only. The **closure** is printed below.

Closure: A string $w \in L$ iff it can be obtained from the basis elements by a finite number of applications of the operations in the recursive step.

2. (50 points) Let M_2 be the following NFA- λ :



(a) Give the transition function t for M_2 in tabular form. Include a column for the λ -closure of each state.

(b) Use algorithm 5.6.3 to construct a state diagram of a DFA that is equivalent to M_2 . Give the transition function and draw the state diagram of the equivalent DFA.