

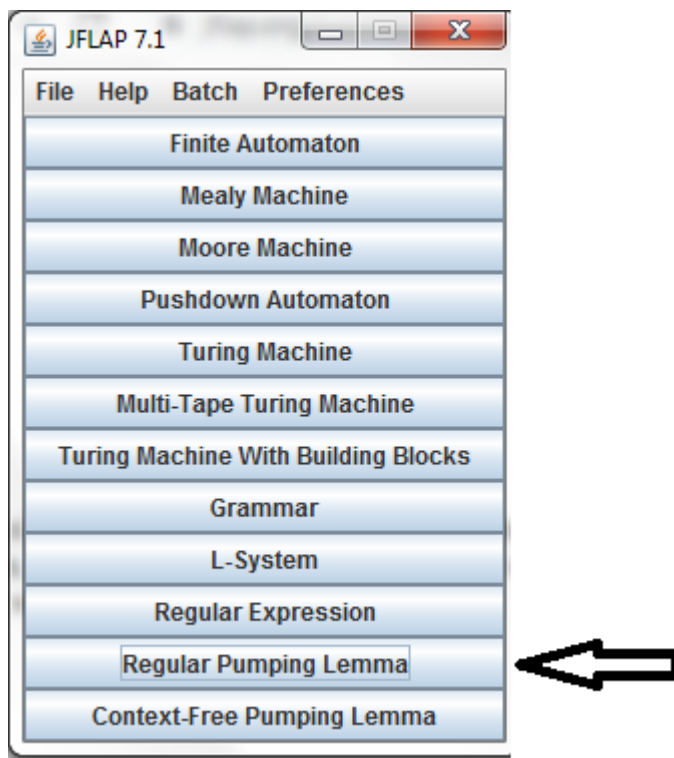
Practical series3(solution)

Exercise1

Pumping lemma If A is a regular language, then there is a number p (the pumping length) where if s is any string in A of length at least p , then s may be divided into three pieces, $s = xyz$, satisfying the following conditions:

1. $\forall i \geq 0, xy^iz \in A$,
2. $|y| > 0$, and
3. $|xy| \leq p$.

In other words, any sufficiently long string in L can be broken down into three parts such that any number of repetitions(concatenation) of the middle part (pumping the middle part) will still yield in a string in L .



JFLAP : <untitled3>

File Help

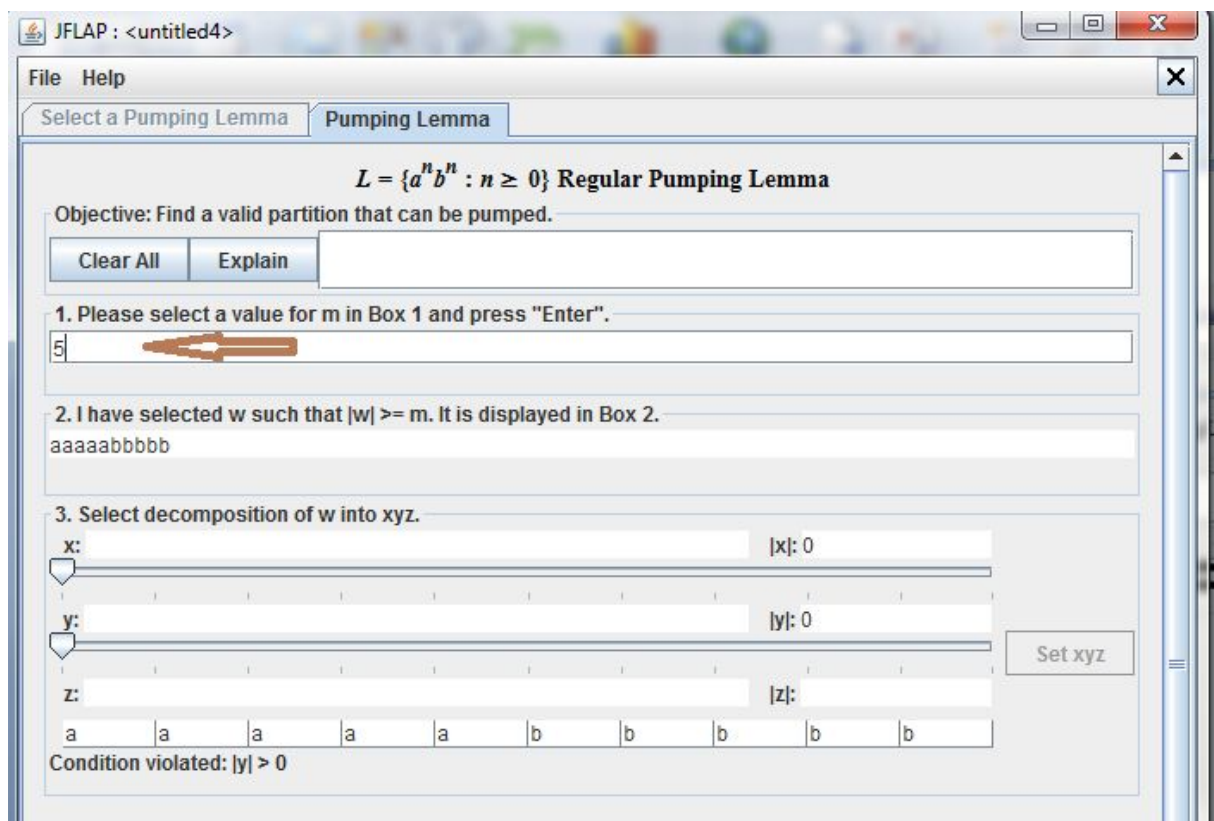
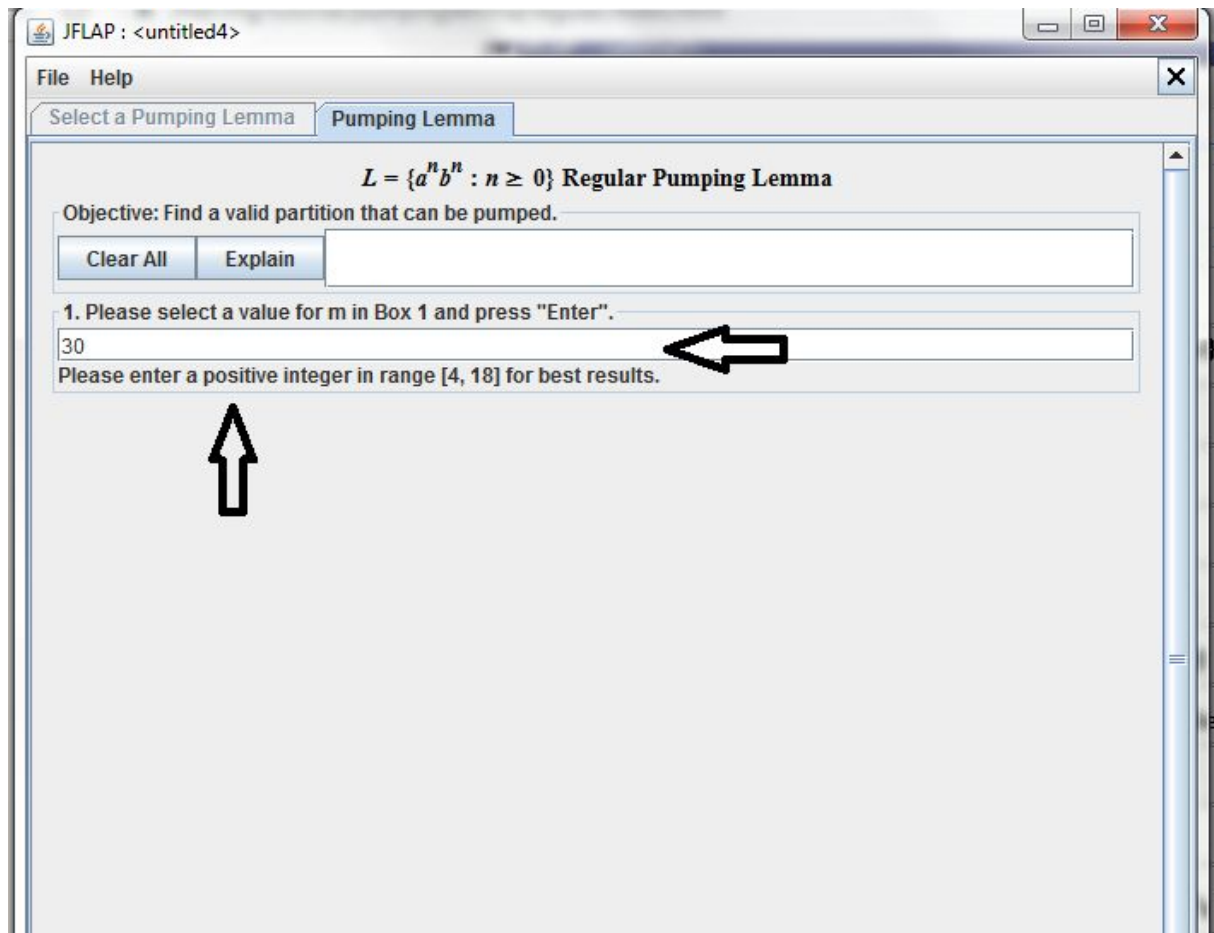
Select a Pumping Lemma

First choose who makes the first move.

☒ You go first ☐ Computer goes first

Then select a lemma.

$L = \{a^n b^n : n \geq 0\}$	Select
$L = \{w \in \{a, b\}^* : n_a(w) < n_b(w)\}$	Select
$L = \{ww^R : w \in \{a, b\}^*\}$	Select
$L = \{(ab)^n a^k : n > k, k \geq 0\}$	Select
$L = \{a^n b^k c^{n+k} : n \geq 0, k \geq 0\}$	Select
$L = \{a^n b^l a^k : n > 5, l > 3, k \leq l\}$	Select
$L = \{a^n : n \text{ is even}\}$	Select
$L = \{a^n b^k : n \text{ is odd or } k \text{ is even.}\}$	Select
$L = \{bba(ba)^n a^{n-1}\}$	Select
$L = \{b^5 w : w \in \{a, b\}^*, 2n_a(w) = 3n_b(w)\}$	Select
$L = \{b^5 w : w \in \{a, b\}^*, (2n_a(w) + 5n_b(w)) \bmod 3 = 0\}$	Select



JFLAP : <untitled4>

File Help

Select a Pumping Lemma Pumping Lemma

$L = \{a^n b^n : n \geq 0\}$ Regular Pumping Lemma

Objective: Find a valid partition that can be pumped.

Clear All Explain

1. Please select a value for m in Box 1 and press "Enter".

5

2. I have selected w such that $|w| \geq m$. It is displayed in Box 2.

aaaaabbbb

3. Select decomposition of w into xyz.

x: a |x|: 1

y: aa |y|: 2

z: aabbbb |z|: 7

a a a a a b b b b

Set xyz

Click "Set xyz" to set decomposition.



File
Help

Select a Pumping Lemma
Pumping Lemma

$L = \{a^n b^n : n \geq 0\}$ Regular Pumping Lemma

Objective: Find a valid partition that can be pumped.

Clear All
Explain
My Attempts:

1. Please select a value for m in Box 1 and press "Enter".

5

2. I have selected w such that $|w| \geq m$. It is displayed in Box 2.

aaaaabbbb

3. Select decomposition of w into xyz.

x: a
|x|: 1

y: aa
|y|: 2

z: aabbbb
|z|: 7

Set xyz

4. I have selected i to give a contradiction. It is displayed in Box 4.

i: 2
pumped string: aaaaaabbbb

5. Animation

$$\begin{array}{ccccc}
 & x & y & & z \\
 w = & a & aa & aabbbb
 \end{array}$$

$xy^2z = a^7b^5 = aaaaaabbbb$ is NOT in the language. Please try again.

Step
Restart

2. I have selected w such that $|w| \geq m$. It is displayed in Box 2.
 aaaaaabbbb

3. Select decomposition of w into xyz.

x: a |x|: 1
 y: aa |y|: 2
 z: aabbbb |z|: 7

a a a a a b b b b

Set xyz

4. I have selected i to give a contradiction. It is displayed in Box 4.
 i: 2 pumped string: aaaaaabbbb

5. Animation

x y z
 w = a aa aabbbb
 aaaaaabbbb

$xy^2z = a^7b^5 = \text{aaaaaabbbb}$ is NOT in the language. Please try again.

Step Restart

See also

JFLAP : <untitled4>

File Help

Select a Pumping Lemma Pumping Lemma

$L = \{a^n b^n : n \geq 0\}$ Regular Pumping Lemma

Objective: Find a valid partition that can be pumped.

Clear All Explain my attempts.

1: X = a; Y = aa; Z = aabbbb; I = 2; Failed

1. Please select a value for m in Box 1 and press "Enter".
 5

2. I have selected w such that $|w| \geq m$. It is displayed in Box 2.
 aaaaaabbbb

3. Select decomposition of w into xyz.

x: a |x|: 1
 y: aa |y|: 2
 z: aabbbb |z|: 7

a a a a a b b b b

Set xyz

4. I have selected i to give a contradiction. It is displayed in Box 4.
 i: 2 pumped string: aaaaaabbbb

Remark:

- You may do few attempts, by changing the value of m, by pressing Clear All button.
- After a few attempts, you may notice that you never win,

Now return the home screen and select **Computer Goes first**.

The screenshot shows the JFLAP application window titled "JFLAP : <untitled1>". The "Pumping Lemma" tab is active. The language is defined as $L = \{a^n b^n : n \geq 0\}$ Regular Pumping Lemma. The objective is to prevent the computer from finding a valid partition.

The interface includes a "Clear All" button and an "Explain" button. The "My Attempts:" section shows a list of attempts. The current attempt is as follows:

1. I have selected a value for m, displayed below.
6
2. Please enter a possible value for w and press "Enter".
aaaabbbb
3. I have decomposed w into the following...
X = a; Y = aaabb; Z = bb
4. Please enter a possible value for i and press "Enter".
i: 2 pumped string: aaaabbaaaabbbb

5. Animation

The animation shows the decomposition of w into x, y, and z:

$$w = a \quad aaabb \quad bb$$
$$x = a, y = aaabb, z = bb$$

The pumped string is shown as:

$$aaaabbaaaabbbb$$

At the bottom, the result of the pumping is shown:

$$xy^2z = a^4b^2a^3b^4 = aaaabbaaaabbbb \text{ is NOT in the language. YOU WIN!}$$

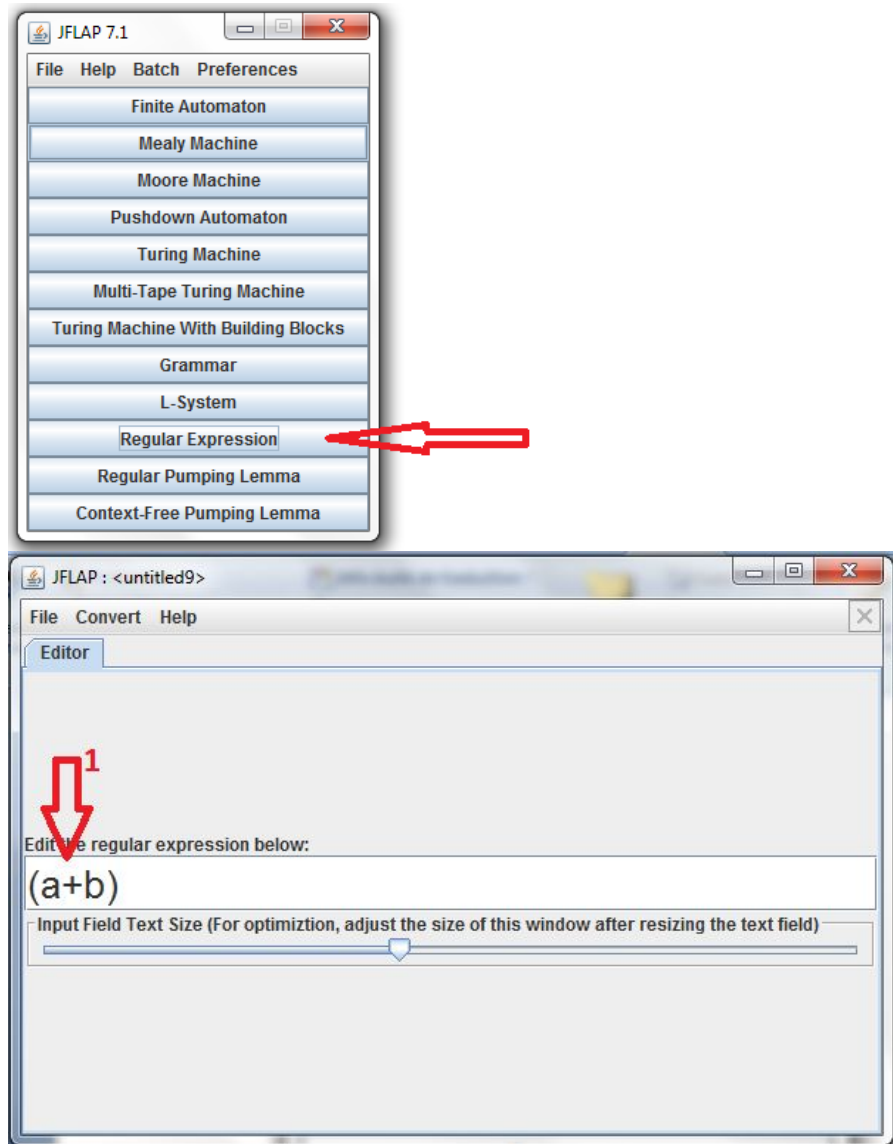
Red arrows point to the "Step" and "Restart" buttons.

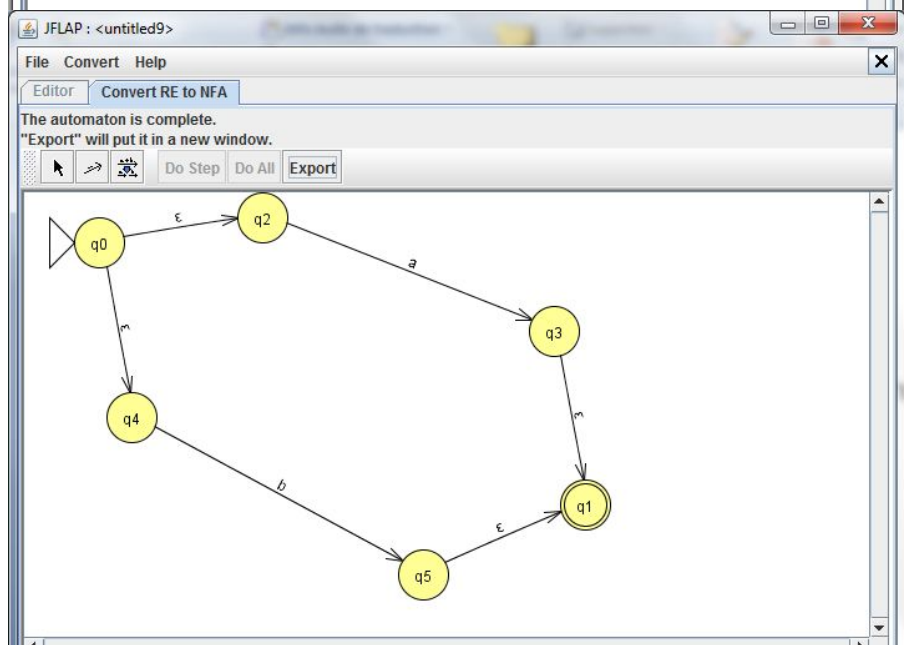
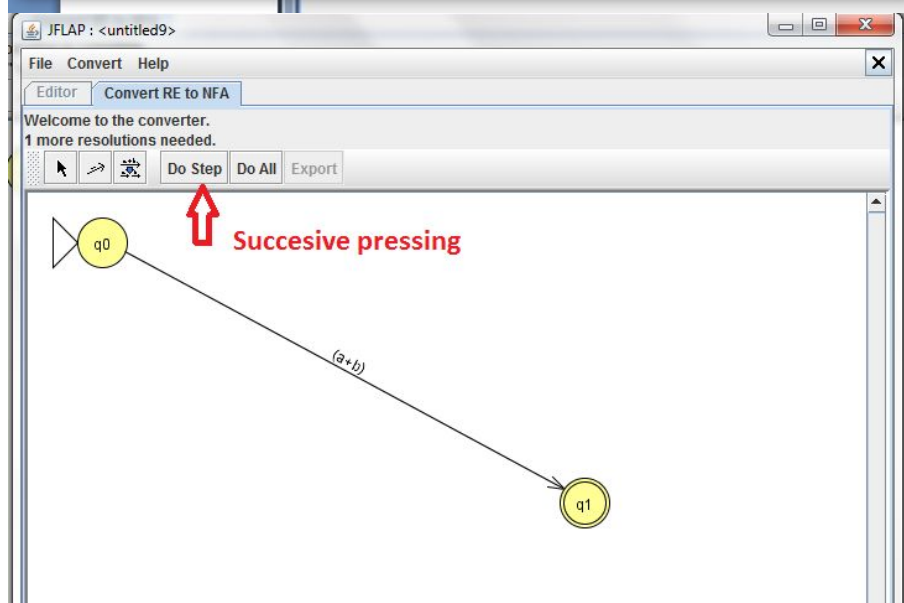
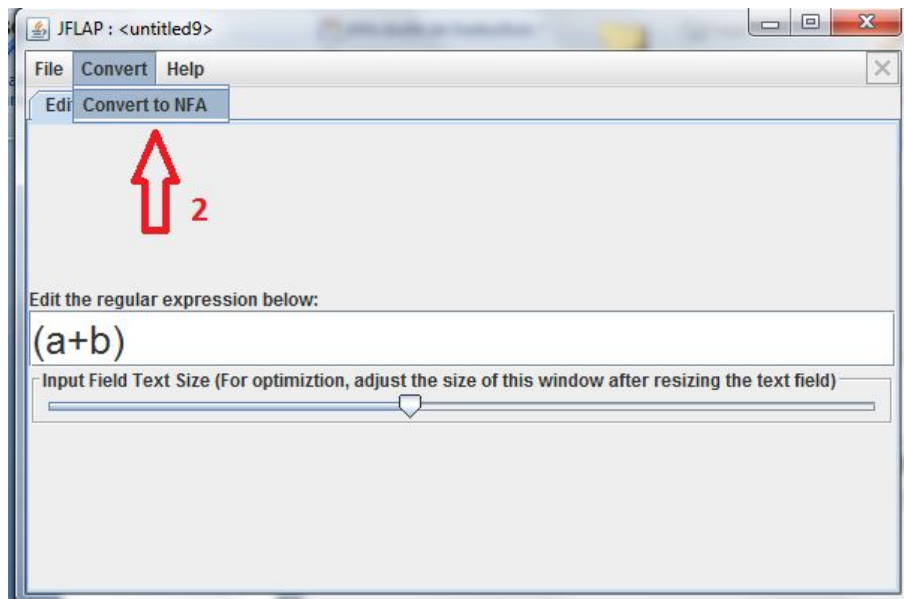
Remark

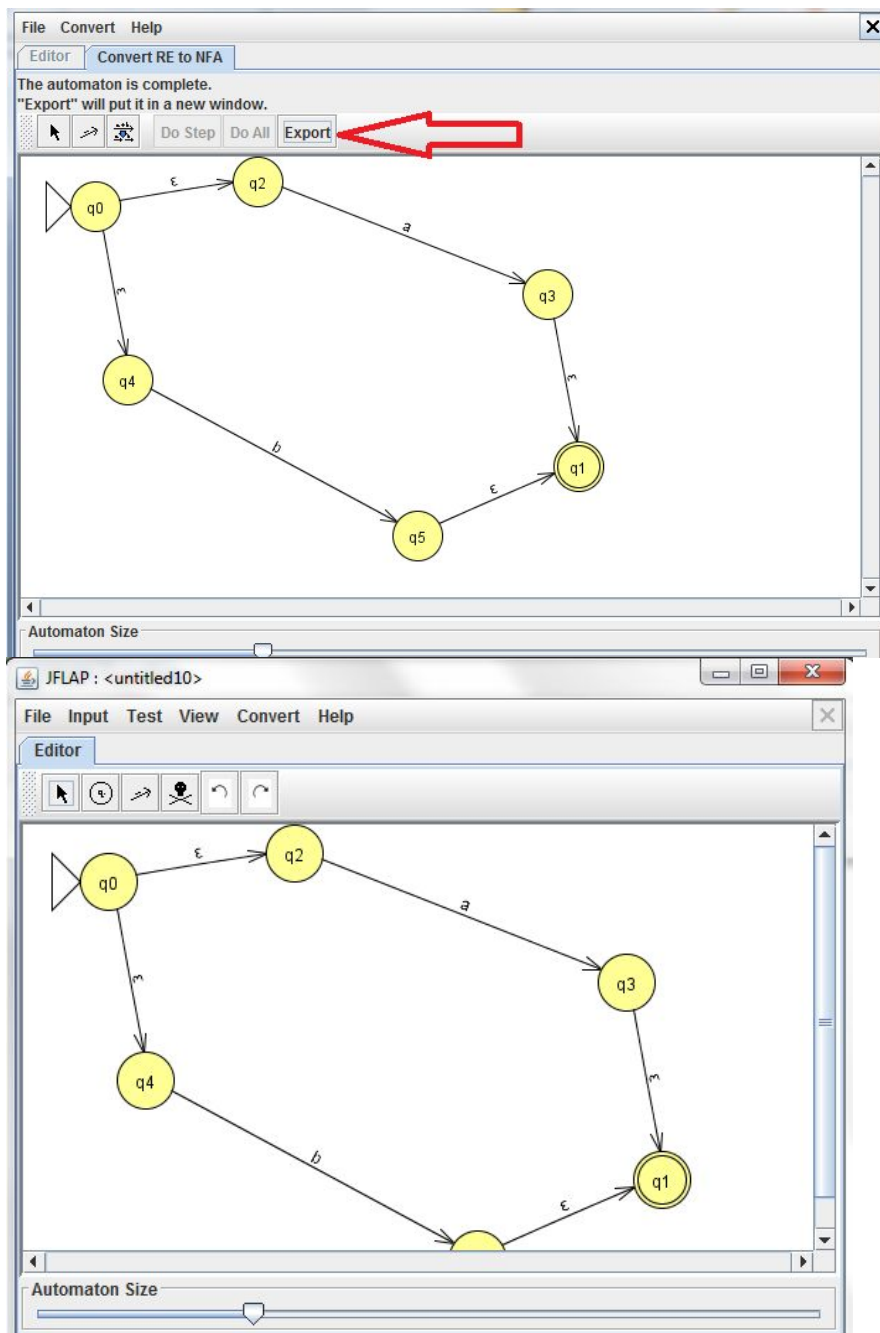
You've won, because the computer could not choose a valid decomposition, and never reach a valid decomposition as proved in our course.

And we know that $\{a^n b^n, n \in N\}$ is a context-free language(type2).

Exercise2







Repeat the same steps for the other regular expressions.

Thanks.