



Bangalore Institute of Technology
K.R. ROAD, BENGALURU-560004.

Department of Computer Science and Engineering

Automata Theory and Computability
18CS54

Assignment

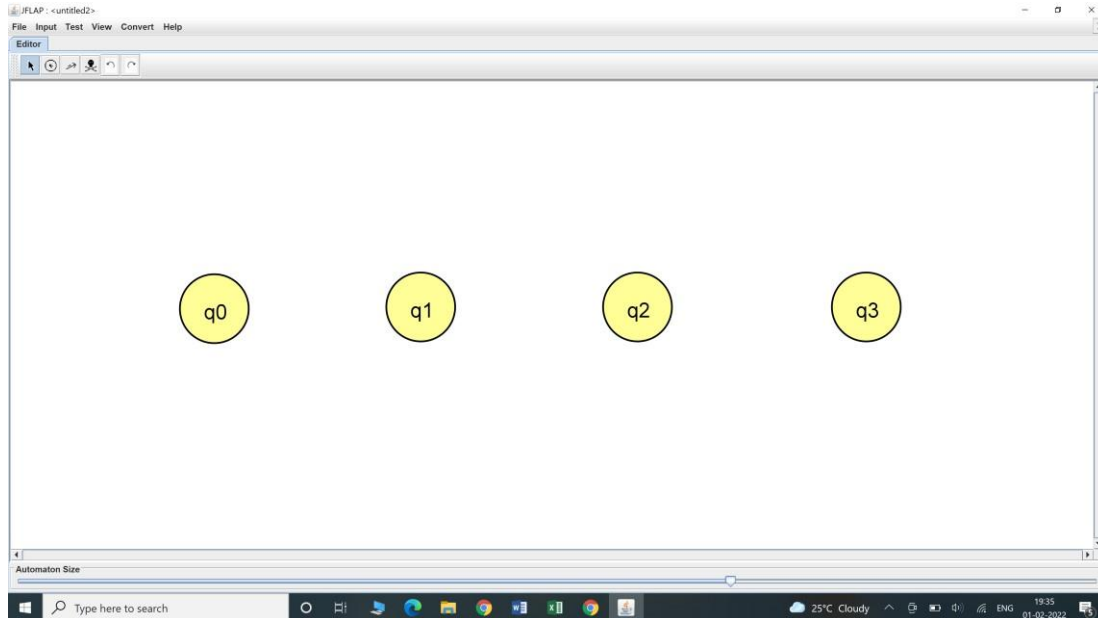
Submitted by
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1BI19CS011
SEM - 5
SEC - A

Faculty In-charge
N.Thanuja

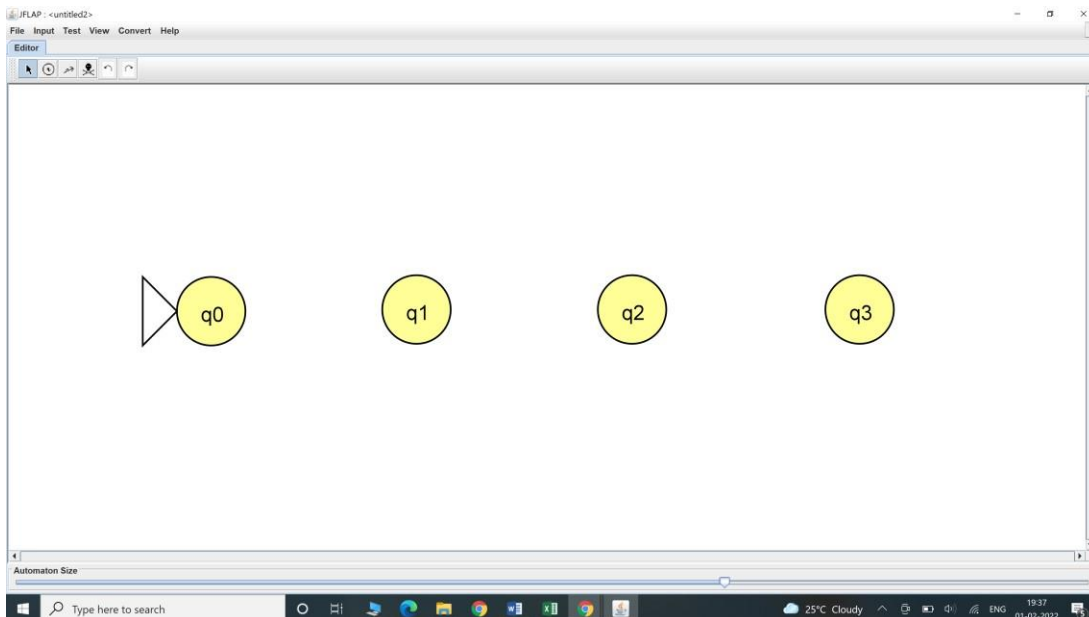
Tracing of machines:

1) Obtain a DFSA such that, $L = \{ w \in \{a,b\}^* : w \text{ contains the substring ending with } abb \}$

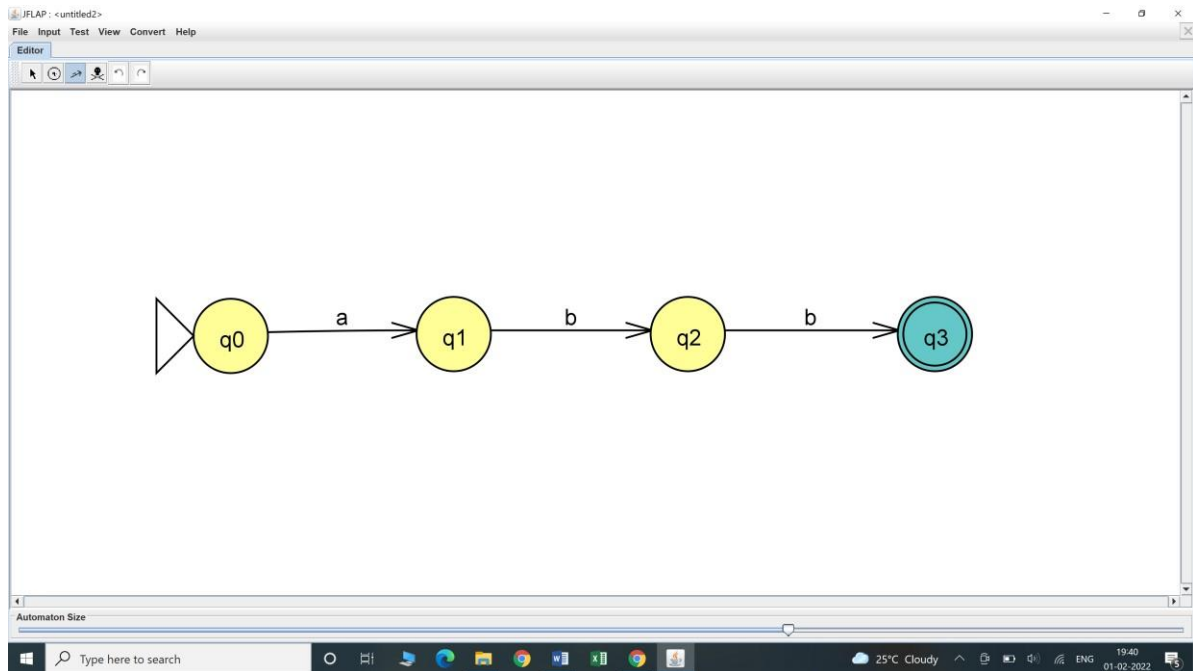
Step 1: For a machine to end with abb as a substring, 4 states are required.



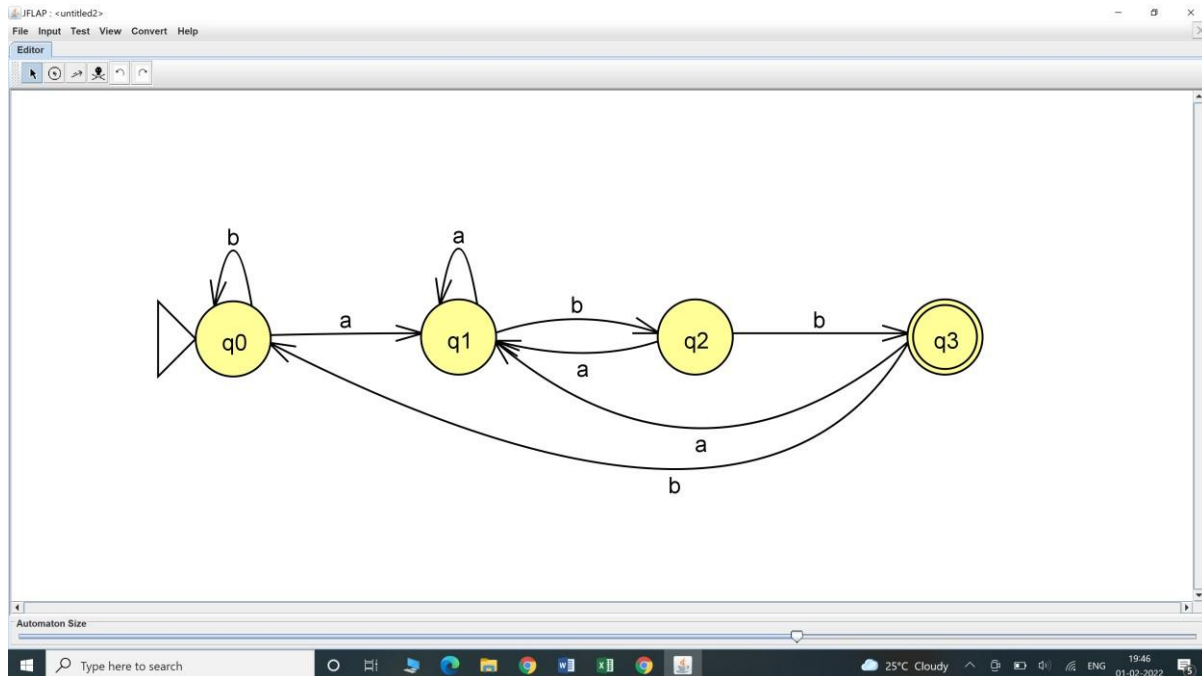
Step 2: Mark the initial state



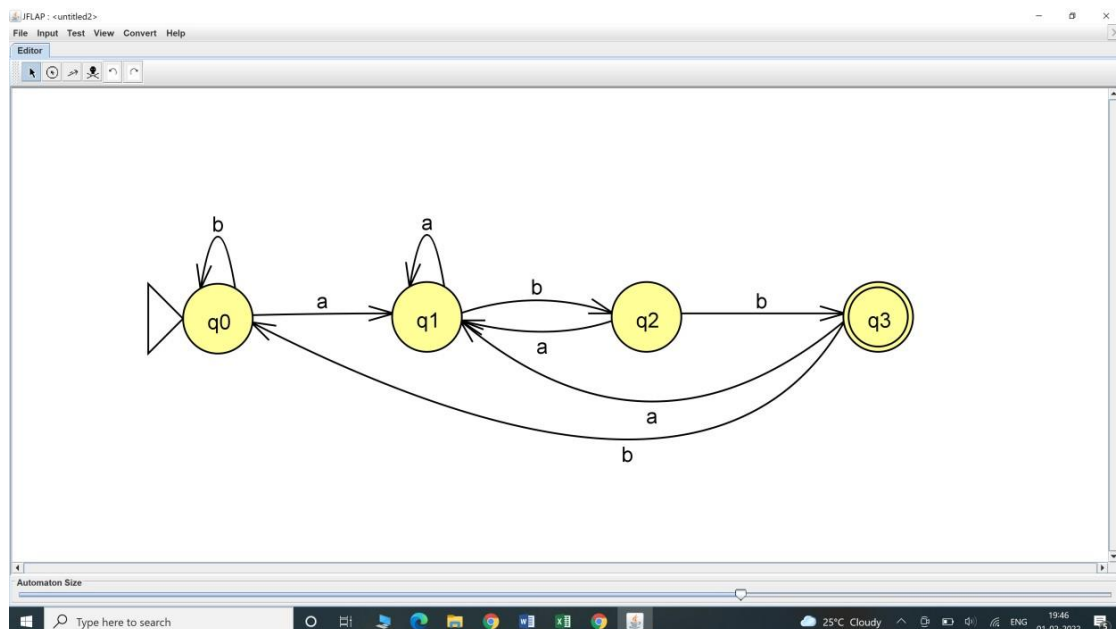
Step 3: Mark the final state showing that machine accepts substring abb.



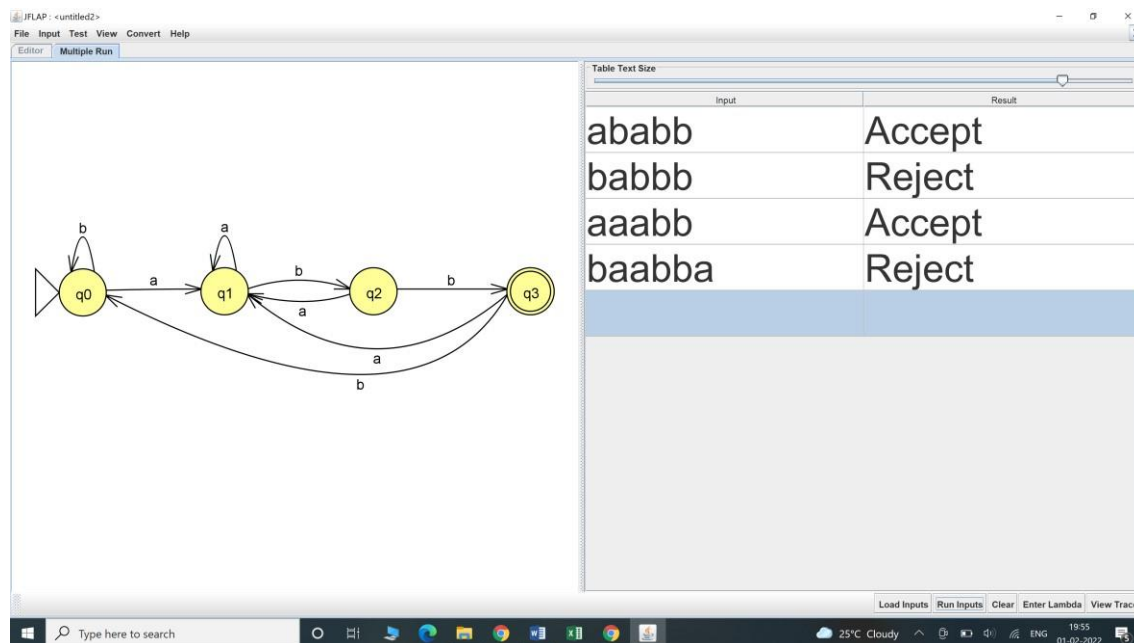
Step 4: Since there are two input alphabets, each state should make transition upon those two input alphabets.



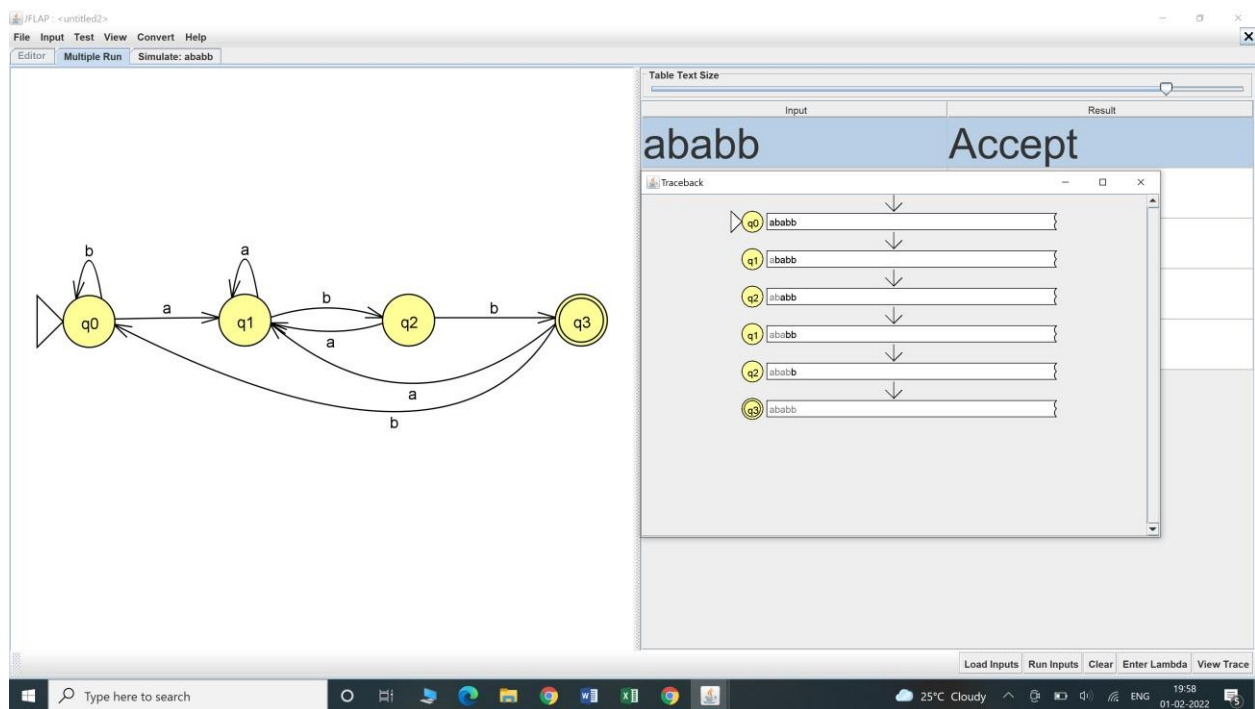
Step 5: The final DFSM for a machine to accept strings of a's and b's and contain a substring ending with abb is



Consider few strings of the following inputs showing whether the machine accept/reject the string



Accept



Reject

IFLAP - <untitled2>

File Input Test View Convert Help

Editor Multiple Run Simulate: ababb

Table Text Size

| Input | Result |
|-------|--------|
| ababb | Accept |
| babbb | Reject |

Traceback

q0 babbb

q0 ababb

q1 babbb

q2 babbb

q3 babbb

q0 babbb

Load Inputs Run Inputs Clear Enter Lambda View Trace

Type here to search

25°C Cloudy

ENG 19:59 01-02-2022

Accept

IFLAP - <untitled2>

File Input Test View Convert Help

Editor Multiple Run Simulate: ababb

Table Text Size

| Input | Result |
|-------|--------|
| ababb | Accept |
| babbb | Reject |
| aaabb | Accept |

Traceback

q0 aaabb

q1 aaabb

q1 aaabb

q1 aaabb

q2 aaabb

q3 aaabb

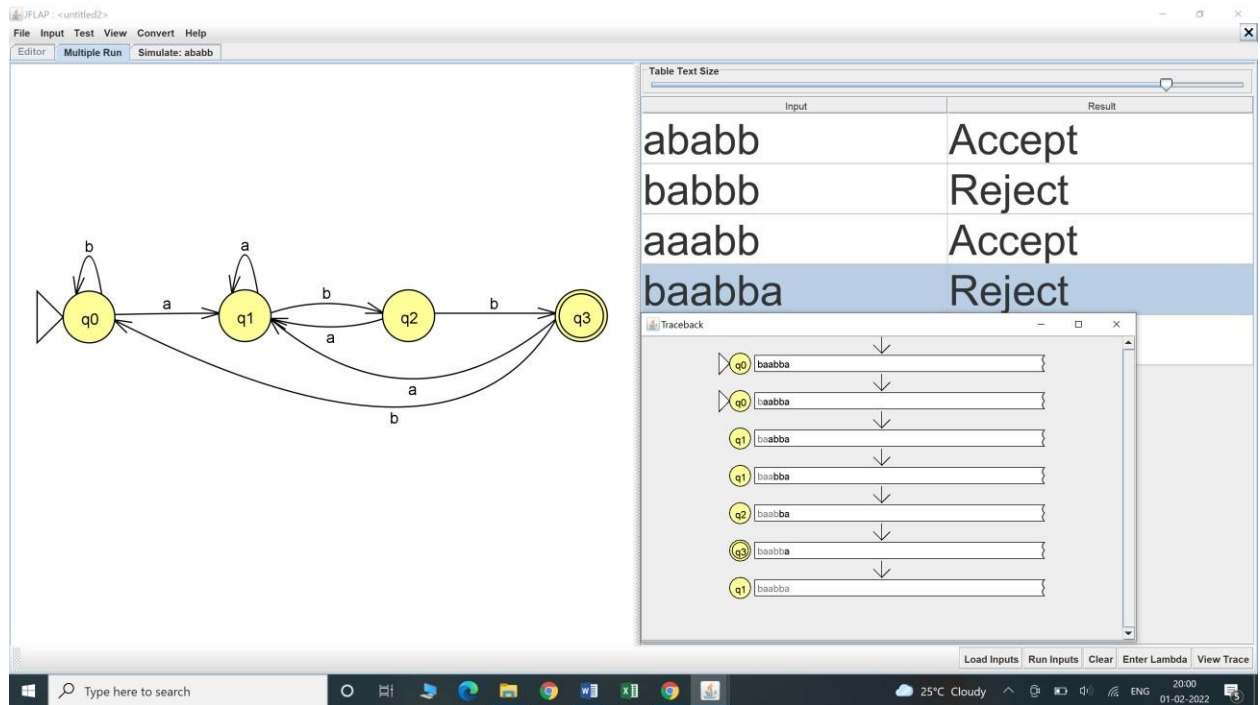
Load Inputs Run Inputs Clear Enter Lambda View Trace

Type here to search

25°C Cloudy

ENG 20:00 01-02-2022

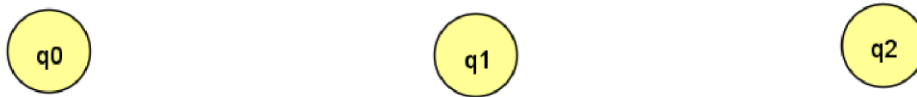
Reject



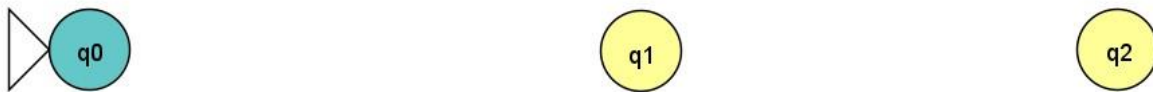
2) Obtain a DFMSM for the language $L = \{w \in \{a, b\}^* : w \text{ does not contain the string } aab\}$

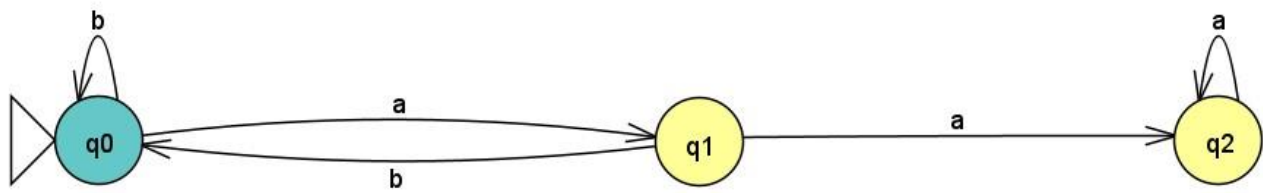
Step 1: For the DFMSM to not contain aab as substring we need three states. Type your text

Step 2: Mark q_0 as initial state.



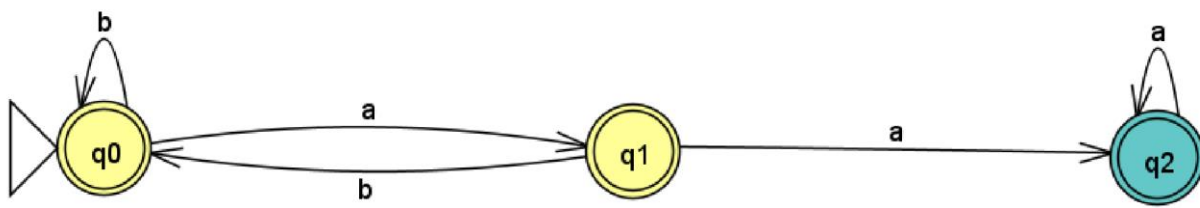
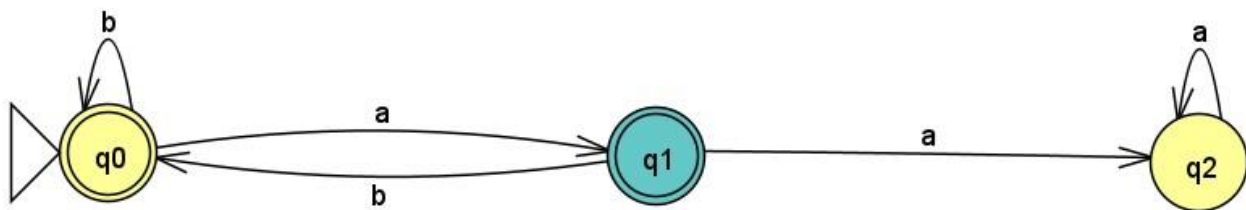
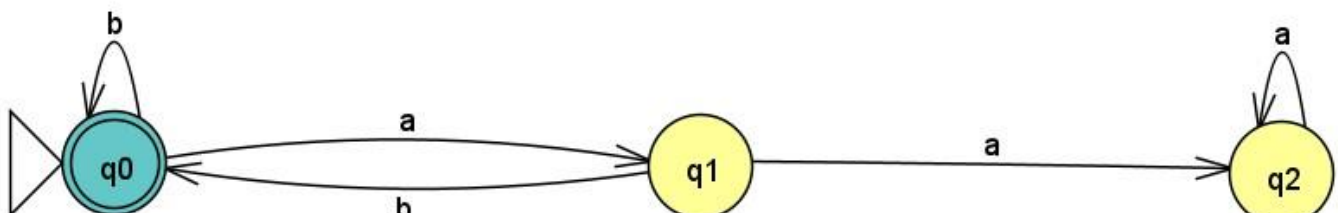
Step 3: For the language to contain no aab as a substring we make the transitions as following..

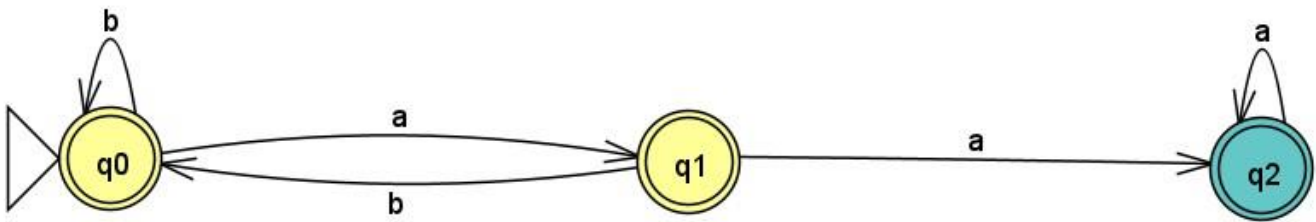




Step 4: Mark q0,q1 and q2 as final states.

Step 5: The final DFSM is





Consider few strings of the following inputs showing whether the machine accept/reject the string

ACCEPT

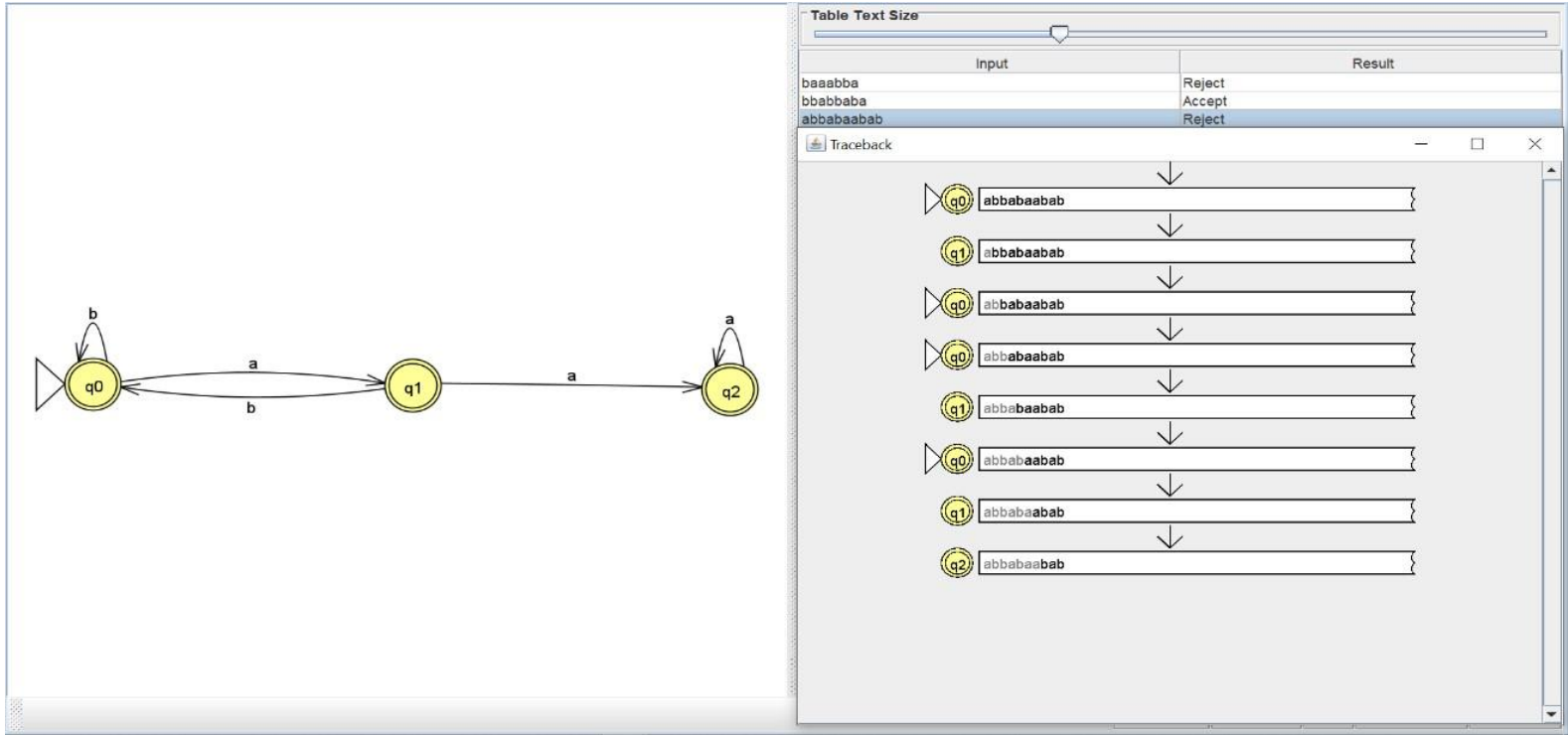
REJE

```

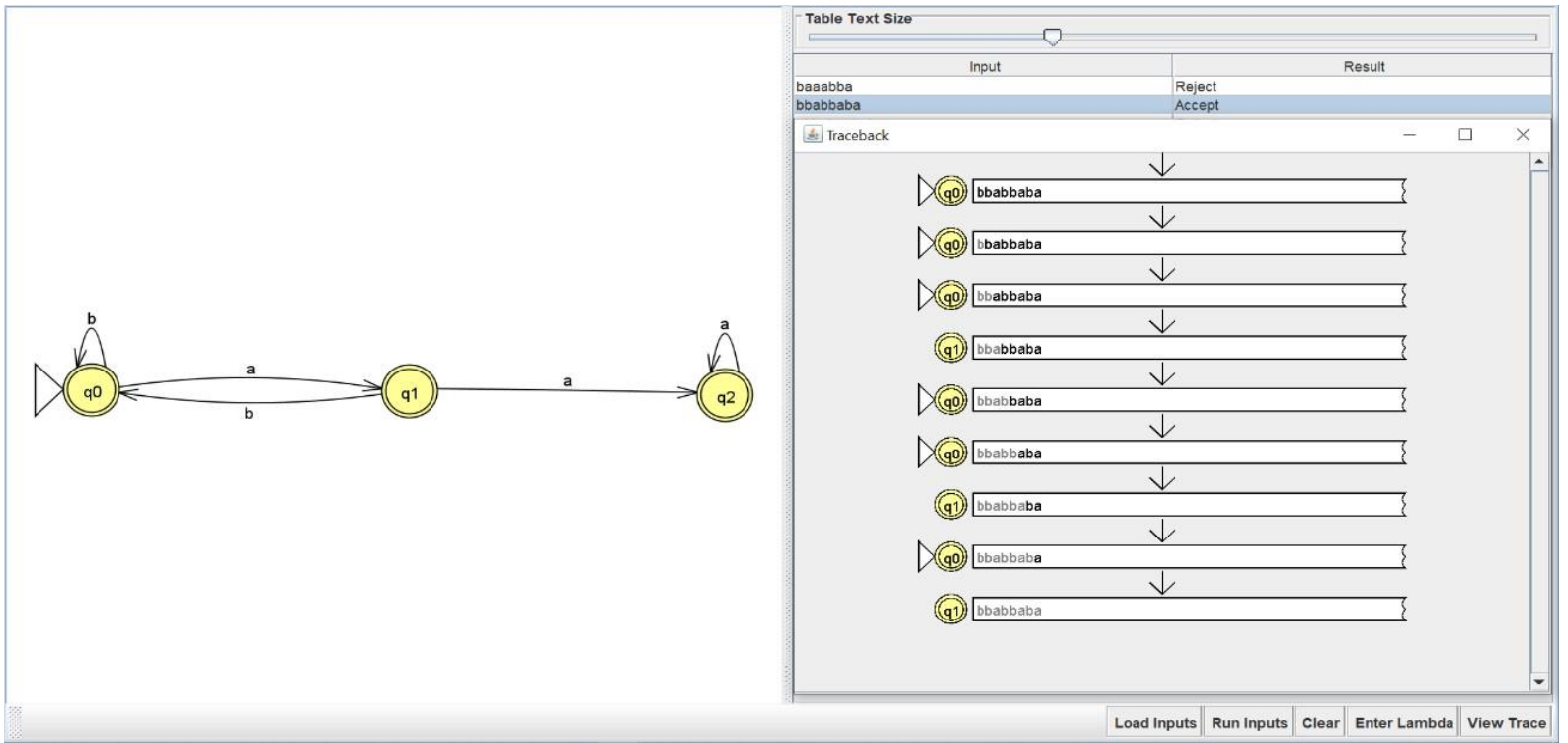
graph LR
    start(( )) --> q0((q0))
    q0 -- b --> q0
    q0 -- a --> q1((q1))
    q1 -- b --> q0
    q1 -- a --> q2(((q2)))
    q2 -- a --> q2
  
```

| Input | Result |
|------------|--------|
| baaabba | Reject |
| bbabbaba | Accept |
| abbabaabab | Reject |
| abbabbbab | Accept |

Traceback



EP



REJE

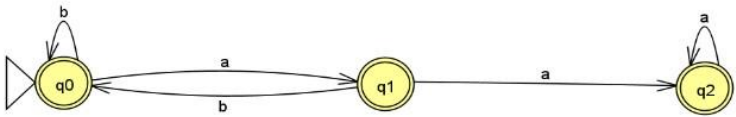


Table Text Size

| Input | Result |
|---------|--------|
| baaabba | Reject |

Traceback

q0

baaabba

q0

baaabba

q1

q2

q2

Load Inputs

Run Inputs

Clear

Enter Lambda

View Trace

Grammars:

1) Convert the given grammar to Chomsky Normal Form

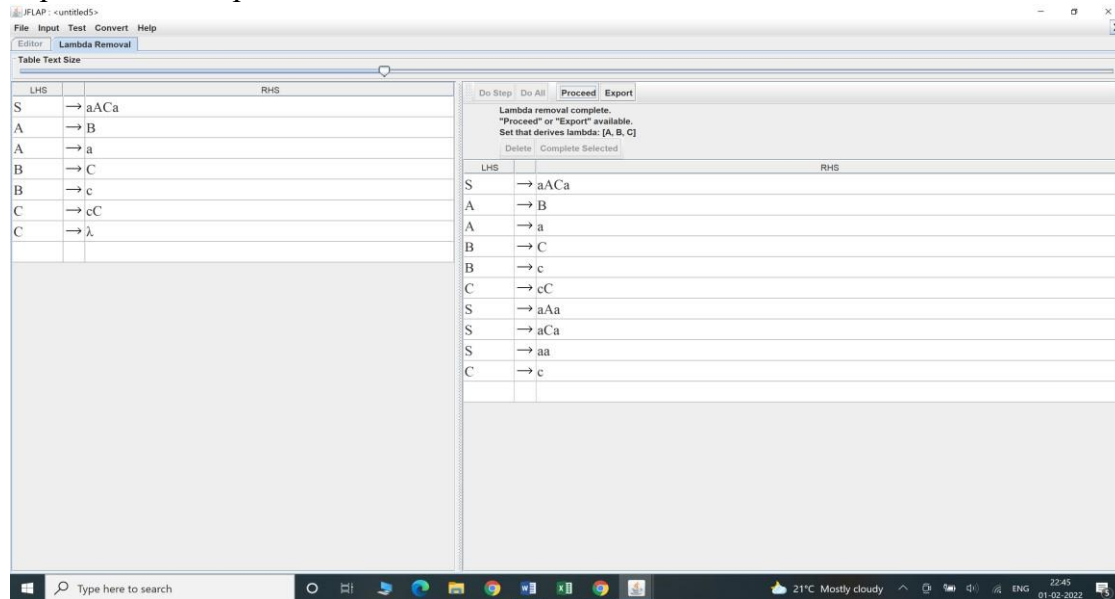
$S \rightarrow aACa$

$A \rightarrow B|a$

$B \rightarrow C|c$

$C \rightarrow cC | \epsilon$

Step 1: Remove ϵ productions



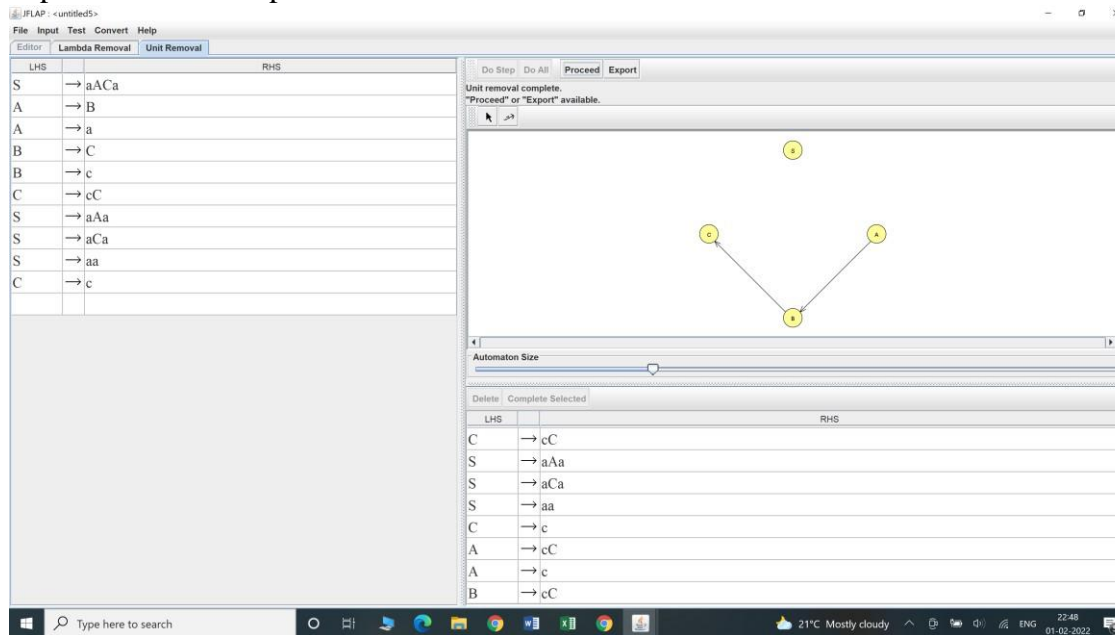
The screenshot shows the JFLAP interface with the 'Lambda Removal' window open. The window displays a table of productions and a list of derived strings.

| LHS | RHS |
|-----|-----------------------|
| S | $\rightarrow aACa$ |
| A | $\rightarrow B$ |
| A | $\rightarrow a$ |
| B | $\rightarrow C$ |
| B | $\rightarrow c$ |
| C | $\rightarrow cC$ |
| C | $\rightarrow \lambda$ |

Below the table, a list of strings is shown: $aACa$, aAa , aCa , aa , c .

The 'Do Step' button is highlighted, and the 'Proceed' button is also visible. A message box indicates: 'Lambda removal complete. "Proceed" or "Export" available. Set that derives lambda: [A, B, C]'.

Step 2: Remove unit productions



The screenshot shows the JFLAP interface with the 'Unit Removal' window open. The window displays a table of productions and a diagram of the resulting grammar.

| LHS | RHS |
|-----|--------------------|
| S | $\rightarrow aACa$ |
| A | $\rightarrow B$ |
| A | $\rightarrow a$ |
| B | $\rightarrow C$ |
| B | $\rightarrow c$ |
| C | $\rightarrow cC$ |
| S | $\rightarrow aAa$ |
| S | $\rightarrow aCa$ |
| S | $\rightarrow aa$ |
| C | $\rightarrow c$ |

The diagram shows a state transition graph with three states: a start state (yellow circle) and two other states (yellow circles). The transitions are labeled with 'a', 'c', and 'A'.

The 'Do Step' button is highlighted, and the 'Proceed' button is also visible. A message box indicates: 'Unit removal complete. "Proceed" or "Export" available.'

Step 3: Remove mixed productions

JFLAP: <untitled5>

File Input Test Convert Help

Editor Lambda Removal Unit Removal Useless Removal

| LHS | RHS |
|-----|--------|
| S | → aACa |
| S | → aAa |
| S | → aCa |
| S | → aa |
| B | → cC |
| A | → c |
| A | → cC |
| C | → c |
| C | → cC |
| B | → c |
| A | → a |

Do Step Do All Proceed Export

Useless removal complete.
 "Proceed" or "Export" available.
 Variables that predicate terminals: [A, B, C, S]

Automaton Size

| LHS | RHS |
|-----|--------|
| S | → aACa |
| S | → aAa |
| S | → aCa |
| S | → aa |
| A | → c |
| A | → cC |
| C | → c |
| C | → cC |
| A | → a |

Type here to search

21°C Mostly cloudy 22:49 01-02-2022

Step 4: CNF

JFLAP: <untitled5>

File Input Test Convert Help

Editor Lambda Removal Unit Removal Useless Removal Chomsky Converter

Table Text Size

| LHS | RHS |
|-----|--------|
| S | → aACa |
| S | → aAa |
| S | → aCa |
| S | → aa |
| A | → a |
| C | → cC |
| C | → c |
| A | → cC |
| A | → c |

Convert Selected Do All What's Left? Export

All productions completed.
 Table Text Size

Conversion done. Press "Export" to use.

| LHS | RHS |
|------|------------|
| S | → B(a)D(3) |
| D(3) | → AD(1) |
| S | → B(a)D(2) |
| D(2) | → AB(a) |
| S | → B(a)D(1) |
| D(1) | → CB(a) |
| S | → B(a)B(a) |
| B(a) | → a |
| A | → a |
| C | → B(c)C |
| C | → c |
| A | → B(c)C |
| B(c) | → c |
| A | → c |

Type here to search

21°C Mostly cloudy 22:52 01-02-2022

2) Convert the given grammar to Chomsky Normal Form

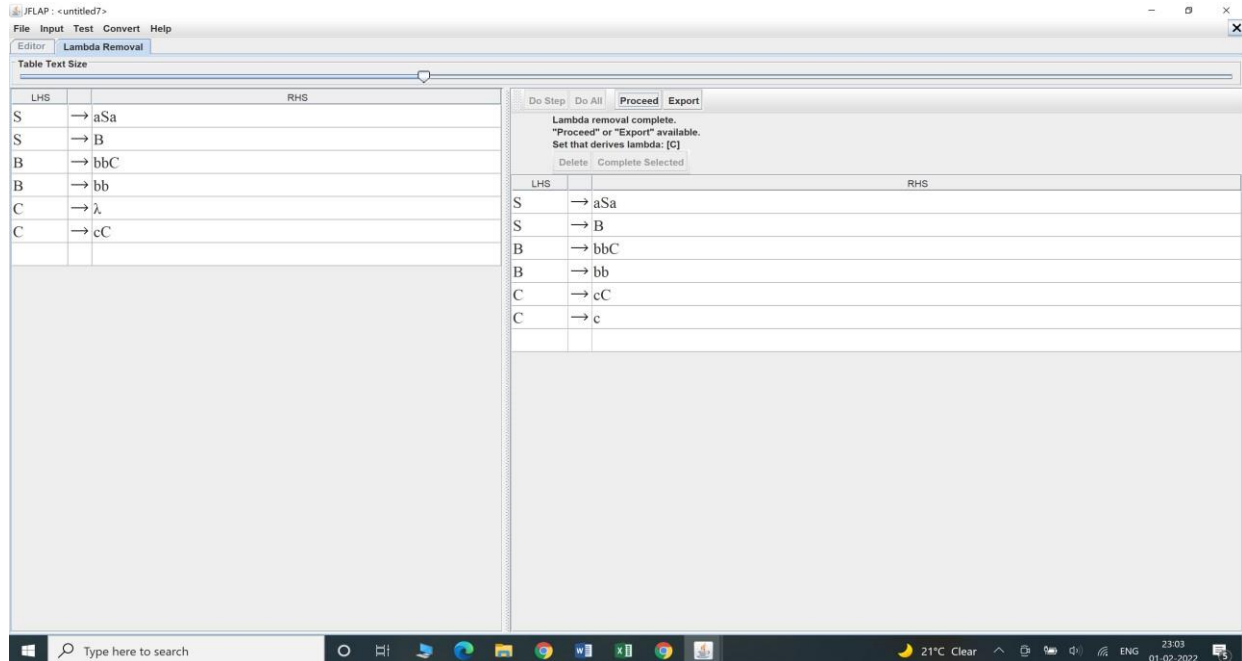
$S \rightarrow aSa$

$S \rightarrow B$

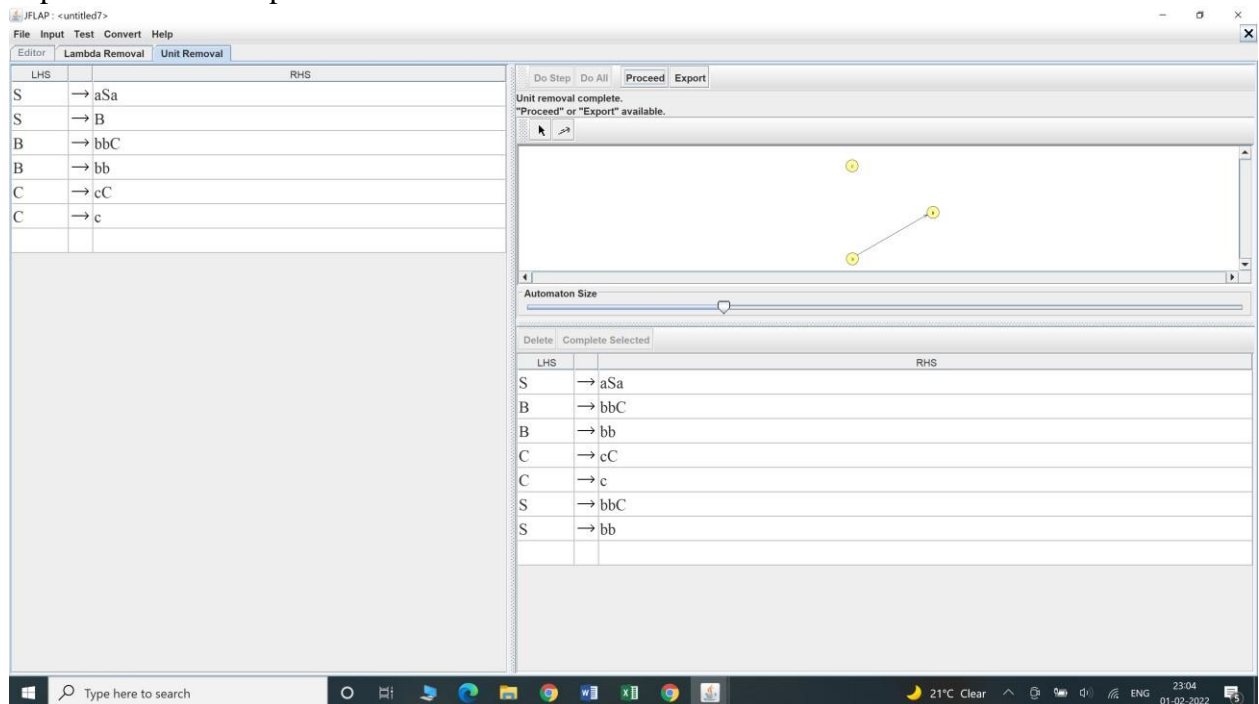
$B \rightarrow bbC \mid bbC$

$\rightarrow \epsilon \mid cC$

Step 1: Remove ϵ productions



Step 2: Remove unit productions



Step 3: Remove mixed productions

JFLAP: <untitled7>

File Input Test Convert Help

Editor Lambda Removal Unit Removal Useless Removal

| LHS | RHS |
|-----|-------|
| S | → aSa |
| S | → bbC |
| S | → bb |
| C | → c |
| C | → cC |
| B | → bb |
| B | → bbC |

Do Step Do All Proceed Export

Useless removal complete.
"Proceed" or "Export" available.
Variables that predicate terminals: [B, C, S]

Automaton Size

| LHS | RHS |
|-----|-------|
| S | → aSa |
| S | → bbC |
| S | → bb |
| C | → c |
| C | → cC |

Type here to search

21°C Clear 23:04 01-02-2022

Step 4: CNF

JFLAP: <untitled7>

File Input Test Convert Help

Editor Lambda Removal Unit Removal Useless Removal Chomsky Converter

Table Text Size

| LHS | RHS |
|-----|-------|
| S | → aSa |
| S | → bbC |
| S | → bb |
| C | → cC |
| C | → c |

Convert Selected Do All What's Left? Export

All productions completed.

Table Text Size

Conversion done. Press "Export" to use.

| LHS | RHS |
|------|------------|
| S | → B(a)D(2) |
| D(2) | → SB(a) |
| B(a) | → a |
| S | → B(b)D(1) |
| D(1) | → B(b)C |
| S | → B(b)B(b) |
| B(b) | → b |
| C | → B(c)C |
| B(c) | → c |
| C | → c |

Type here to search

21°C Clear 23:05 01-02-2022

