



Dr. Balu L. Parne SVNIT is presenting

Microsoft Whiteboard

Converting NFA( $M_N$ ) to DFA ( $M_D$ ) ↗

→ let  $M_N = (Q_N, \Sigma_N, \delta_N, q_{0N}, F_N)$  be given NFA

to construct equivalent DFA  $M_D$

1>  $Q_D = 2^{Q_N}$ , IF NFA has n states  
DFA at most can have  $2^n$  states.

2>  $\Sigma_D = \Sigma_N$



ENG IN  
11:31 AM 2/8/2022

Dr. Balu L. Parne SVNIT

B  
B084 AMANKUMAR CH...

#CAMPUS4UG  
B128 ROHAN SVNIT

B  
B134 KOLA ANU SRI SVN...

B093 Nehal Jhajharia

B101 SURU MANOJ SVNIT

B106 PARIL SVNIT

B  
9 others

You

$$= \underline{\{P_1, P_2, P_3\}}$$

Convert the following NFA to DFA :-



Find the possible set of states :-

$2^2 = 4$  states = All subsets of  $q_0, q_1 = \{\emptyset, q_0, q_1, q_0, q_1\}$

③ Transi-

$$\delta(q_0, 0)$$

$$\delta(q_0, 1)$$

$$\delta(q_1, 0)$$

$$\delta(q_1, 1)$$

$$\delta(\emptyset, 0)$$

$$\delta(\emptyset, 1)$$

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B128 ROHAN SVNIT

B134 KOLA ANU SRI SVN...

B093 Nehal Jhajharia

B101 SURU MANOJ SVNIT

B

B071 ANGELIN JAYISON ...

13 others

B121 AJAY KANHERKAR SVNIT joined



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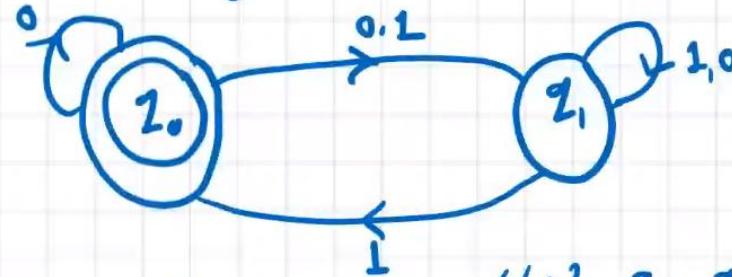
⇒ Convert the following NFA to DFA :-

Find the possible set of states ⇒

$2^2 = 4 \text{ states} = \text{All subsets of } q_0, q_1 = \{\emptyset, q_0, q_1, q_0q_1\}$

Find the initial state  $q_0$

$$\delta((q_0, q_1), 0) = \delta(q_0, 0) \cup \delta(q_1, 0) = [q_0] \cup [q_1]$$



③ Transi

$$\delta(q_0, 0)$$

$$\delta(q_0, 1)$$

$$\delta(q_1, 0)$$

$$\delta(q_1, 1)$$

Dr. Balu L. Parne SVNIT

B  
B084 AMANKUMAR CH...

#CAMPUS4UG  
B128 ROHAN SVNIT

B  
B134 KOLA ANU SRI SVN...

B093 Nehal Jhajharia

B101 SURU MANOJ SVNIT

B  
B071 ANGELIN JAYISON ...

ek  
13 others

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B121 AJAY KANHERKAR  
SVNIT joined



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→ Equivalence between  $\epsilon$ -NFA & NFA  $\Leftrightarrow$

↳ No change in the number of states.

↳ No change in the initial state

↳ may be change in the final state:



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B  
B084 AMANKUMAR CH...

#CAMPUS4UG  
#WELCOME BACK TO CAMPUS

B  
B134 KOLA ANU SRI SVN...

B  
B071 ANGELIN JAYISON ...

B  
B093 Nehal Jhajharia

B  
B100 ADITYA RAJ SVNIT

B  
28 others

You

11:35 AM | Div-B | CS208 | AFL Theory Class





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## → EQUIVALENCE BETWEEN C... →

- ↳ No change in the number of states.
- ↳ No change in the initial state
- ↳ may be change in the final state:

Process: →

$$m = (Q, \Sigma, \delta, q_0, F) \rightarrow \epsilon\text{-NFA}$$

$$m' = (Q', \Sigma', \delta', q_0', F') \rightarrow NFA$$



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#WELCOME BACK TO CAMPUS

B  
B134 KOLA ANU SRI SVN...

B  
B071 ANGELIN JAYISON ...

B  
B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

27 others

You

A small, circular black and white portrait of a man with dark hair and a mustache, wearing a suit and tie. The portrait is set against a dark background.

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$$m = (\Omega, \Sigma, d, q_0, F) \vdash \mathcal{L}^{\text{min}}$$

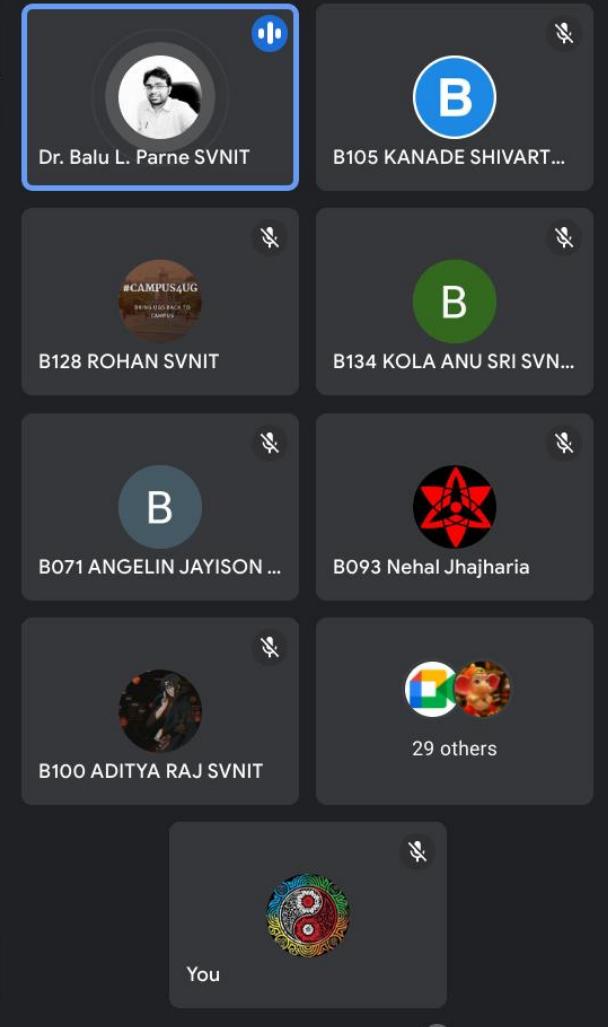
$$M' = (Q', \Sigma', \delta', z_0', F') \rightarrow NFA$$

Initial state  $\Rightarrow q_0' = q_0$

Construction of  $\delta'$   $\delta'(z, a) = \epsilon\text{-closure}(\delta(\epsilon\text{-closure } z, a))$



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construction of  $\delta'$   $\delta'(q, a) = \epsilon\text{-closure}(\delta(\epsilon\text{-closure}(q, q), a))$

Final state: Every state whose  $\epsilon\text{-closure}$  contains the final state of  $\epsilon\text{-NFA}$  is a final state in NFA.

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B105 KANADE SHIVART...

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B134 KOLA ANU SRI SVN...

B071 ANGELIN JAYISON ...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

30 others

You

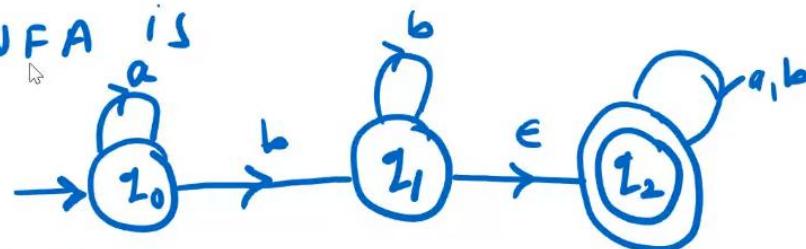


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Final State: Every state which contains the final state of  $\epsilon$ -NFA is a final state in NFA.

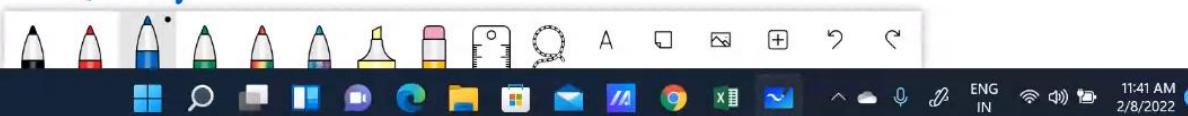
Given  $\epsilon$ -NFA is



$$\epsilon\text{-closure}(q_0) = \{q_0\}$$

$$\epsilon\text{-closure}(q_1) = \{q_1, q_2\}$$

$$\epsilon\text{-closure}(q_2) = \{q_2\}$$

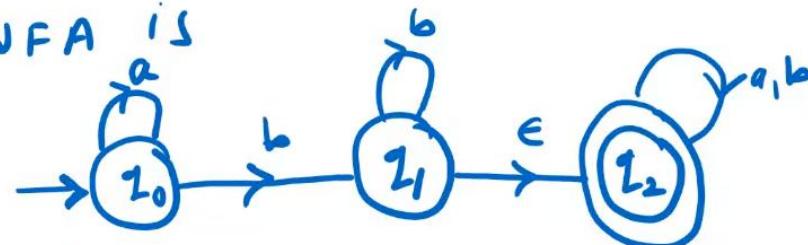


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Contains the Final state or  
start in NFA.

then E-NFA is



$$\delta(q_0) = \{q_0\}$$

$$\delta(q_1) = \{q_1, q_2\}$$

$$\delta(q_2) = \{q_2\}$$

$$\delta'(q_0, a) = \text{e-closure} \left\{ \delta(\text{e-closure } q_0, a) \right\}$$

$$= \text{e-closure} \left\{ \delta(q_0, a) \right\}$$

$$\delta'(q_0, a) = \text{e-closure } \{q_0\} = q_0$$

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B128 ROHAN SVNIT

B134 KOLA ANU SRI SVNIT...

B071 ANGELIN JAYISON...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

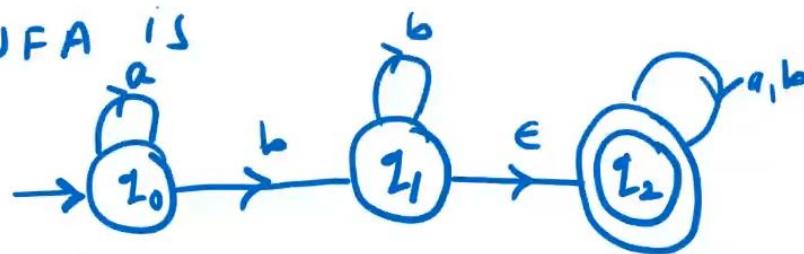
You

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Find the Final state of  $\epsilon$ -NFA

$q_1 \leftarrow$

$\epsilon$ -NFA is



$\{q_0\}$

$\{q_1, q_2\}$

$\{q_2\}$

$$\delta'(q_0, a) = \epsilon\text{-closure} \left\{ \delta(\epsilon\text{-closure}(q_0), a) \right\}$$

$$= \epsilon\text{-closure} \left\{ \delta(q_1) \right\}$$

$$\delta'(q_0, a) = \epsilon\text{-closure} \left\{ \delta(q_1) \right\}$$

$$\delta'(q_0, a) = \epsilon\text{-closure} \left\{ q_1 \right\} = q_1$$

$$\delta'(q_0, b) = \epsilon\text{-closure} \left\{ \delta(\epsilon\text{-closure}(q_0), b) \right\}$$

$$= \epsilon\text{-closure} \left\{ \delta(q_2) \right\}$$

$$= \epsilon\text{-closure} \left\{ q_2 \right\} = q_2$$

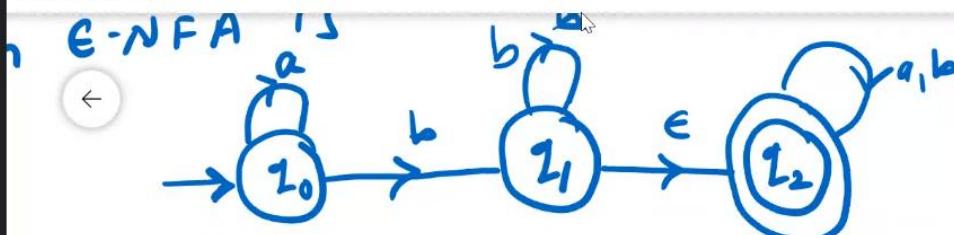
$$\delta'(q_0, b) = \epsilon\text{-closure} \left\{ q_2 \right\} = q_2$$

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#CAMPUSUG	B134 KOLA ANU SRI SVN...
B128 ROHAN SVNIT	B071 ANGELIN JAYISON ...
B093 Nehal Jhajharia	B100 ADITYA RAJ SVNIT
32 others	You



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$$Z_0 = \underline{\{q_0\}}$$

$$Z_1 = \{q_1, q_2\}$$

$$Z_2 = \{q_2\}$$

$$\delta'(q_1, a) = q_2$$

$$\delta'(q_1, b) = q_1, q_2$$

$$\delta'(q_0, a) = \text{e-closure} \left\{ \delta(\text{e-closure } q_0, a) \right\}$$

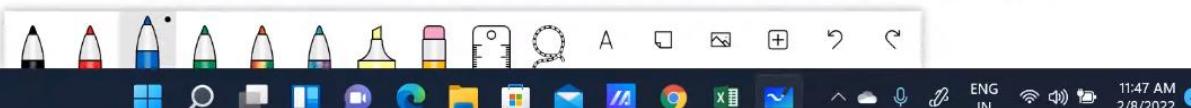
$$\boxed{\delta'(q_0, a)} = \text{E-closure} \left\{ \delta(q_0, a) \right\}$$

$$\delta'(q_0, a) = \text{e-closure } \{q_0\} = q_0$$

$$\delta'(q_0, b) = q_1, q_2$$

$$\delta'(q_2, a) = q_2$$

$$\delta'(q_2, b) = q_2$$



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B105 KANADE SHIVART...

B128 ROHAN SVNIT

B115 G SRI CHANDANA...

B071 ANGELIN JAYISON ...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

You

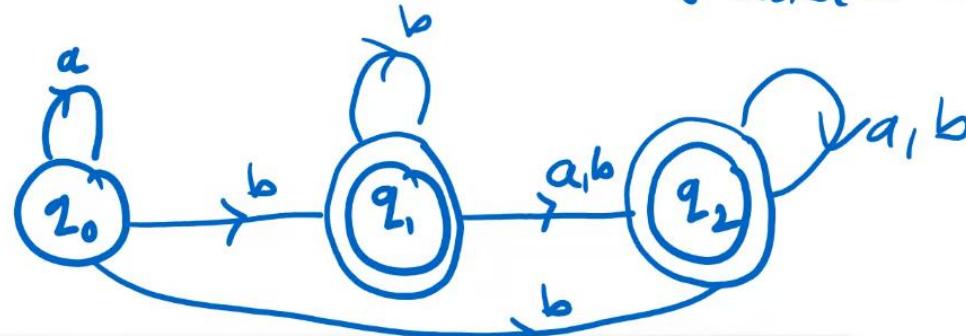


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$$\begin{aligned} & \{q_1, q_2\} \\ & \{q_2\} \\ (q_1, a) &= q_2 \\ (q_1, b) &= q_1 q_2 \end{aligned}$$

$$\begin{aligned} & \boxed{\delta^1(q_0, a)} = \text{E-closure}\{\delta(q_0, a)\} \\ & = \text{E-closure}\{q_0\} = q_0 \\ \delta^1(q_0, b) &= q_1 q_2 \quad \delta^1(q_1, a) = q_2 \\ & \delta^1(q_1, b) = q_2 \end{aligned}$$



11:49 AM | Div-B | CS208 | AFL Theory Class

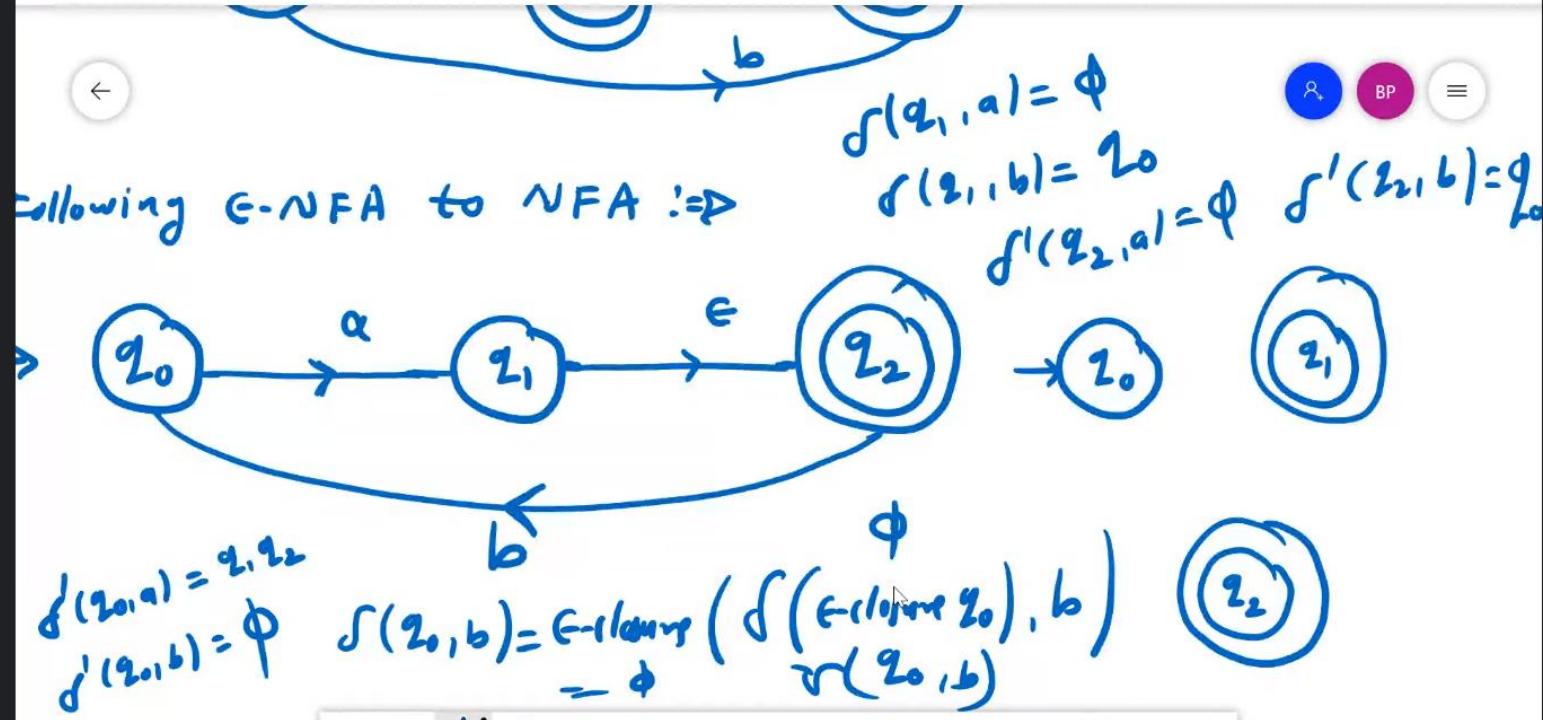


 Dr. Balu L. Parne SVNIT	 B105 KANADE SHIVART...
 #CAMPUSUG	 B115 G SRI CHANDANA ...
 B128 ROHAN SVNIT	 B071 ANGELIN JAYISON ...
 B093 Nehal Jhajharia	 B100 ADITYA RAJ SVNIT
 34 others	 You



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Dr. Balu L. Parne SVNIT

B098 Neelagiri Vijay

#CAMPUSUG

B128 ROHAN SVNIT

B097 GUNJAN SHINDE

B071 ANGELIN JAYISON ...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

37 others

You



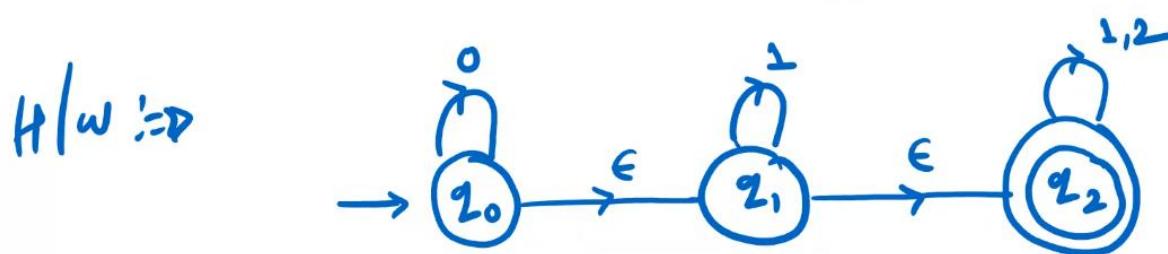
46



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$$\begin{aligned} q_0 \xrightarrow{a} & q_1, q_2 \\ q_0 \xrightarrow{b} & \emptyset \\ \delta(q_0, b) &= \text{closure}(\delta(\text{closure}(q_0), b)) \\ &= \emptyset \end{aligned}$$



Convert this  $\epsilon$ -NFA to NFA.

Participants listed:

- Dr. Balu L. Parne SVNIT
- B098 Neelagiri Vijay
- B128 ROHAN SVNIT
- B097 GUNJAN SHINDE
- B071 ANGELIN JAYISON ...
- B093 Nehal Jhajharia
- B100 ADITYA RAJ SVNIT
- 38 others
- You



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Convert this  $\epsilon$ -NFA to NFA.

→ Equivalence between  $\epsilon$ -NFA and DFA  $\Leftrightarrow$

- ↳ Initial state may be changed.
- ↳ May be change in the number of states also
- ↳ May be change in the final state.



ENG  
IN  
11:59 AM  
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46  
i  
21  
46  
46  
46



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→ Equivalence between  $\epsilon$ -NFA and DFA ↗

- ↳ Initial state may be changed.
  - ↳ May be change in the number of states also
  - ↳ May be change in the final state.
- Initial state in DFA is  $\epsilon$ -closure of initial state in  $\epsilon$ -NFA.



Dr. Balu L. Parne SVNIT

B  
B098 Neelagiri Vijay

#CAMPUSUG  
BRING BACK TO CAMPUS

B  
B097 GUNJAN SHINDE

B  
B071 ANGELIN JAYISON ...

B  
B093 Nehal Jhajharia

B  
B100 ADITYA RAJ SVNIT

B  
37 others

You



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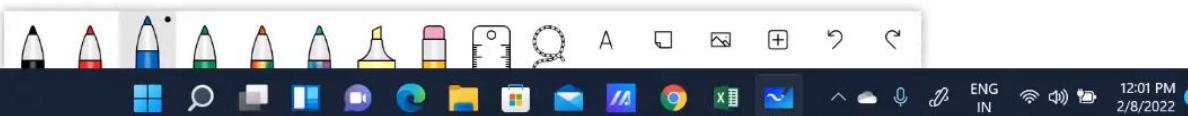
↳ May be change in the final state.

> Initial state in DFA is  $\epsilon$ -closure of initial state in  $\epsilon$ -NFA.

Process:  $\Rightarrow$  let  $m = (\emptyset, \Sigma, \delta, q_0, F) = \epsilon$ -NFA

$m' = (Q', \Sigma, \delta', q'_0, F') = \text{DFA}$

Initial state  $\Rightarrow q'_0 = \epsilon\text{-closure}(q_0)$



12:01 PM | Div-B | CS208 | AFL Theory Class



46  
i

Dr. Balu L. Parne SVNIT

B  
B098 Neelagiri Vijay

#CAMPUSUG  
B128 ROHAN SVNIT

B097 GUNJAN SHINDE

B  
B071 ANGELIN JAYISON ...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

B  
37 others

You



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$$M = (Q, \Sigma, \delta, q_0, F)$$

Initial state  $\Rightarrow q'_0 = \epsilon\text{-closure } (q_0)$

The initial state of DFA is  $\epsilon\text{-closure}$  of initial state of c-NFA.

Construction of  $\delta'$   $\Rightarrow$

Start the construct





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## OF C-NFA.

Construction of  $\delta'$ :

Start the construction of  $\delta'$  with initial state and compute the process for every new state that appears on the column. Terminate the process whenever no new state occurs on input column.



12:03 PM | Div-B | CS208 | AFL Theory Class



The video conference interface displays a list of participants in a grid. Participants include:

- Dr. Balu L. Parne SVNIT (blue box)
- B098 Neelagiri Vijay (orange box)
- #CAMPUSUG (grey box)
- B128 ROHAN SVNIT (grey box)
- B097 GUNJAN SHINDE (blue box)
- B071 ANGELIN JAYISON ... (grey box)
- B089 PATEL DEVANSHI ... (brown box)
- B100 ADITYA RAJ SVNIT (grey box)
- 39 others (blue box)
- You (grey box with a colorful profile picture)



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and compare that appears on the column. Terminated the process whenever no new state occurs on input column

Final state  $\Leftrightarrow$   
Every subset which contains the final state of e-NFA is a final state in DFA.



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Dr. Balu L. Parne SVNIT

B  
B098 Neelagiri Vijay

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B128 ROHAN SVNIT

B097 GUNJAN SHINDE

B  
B071 ANGELIN JAYISON ...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

B  
38 others

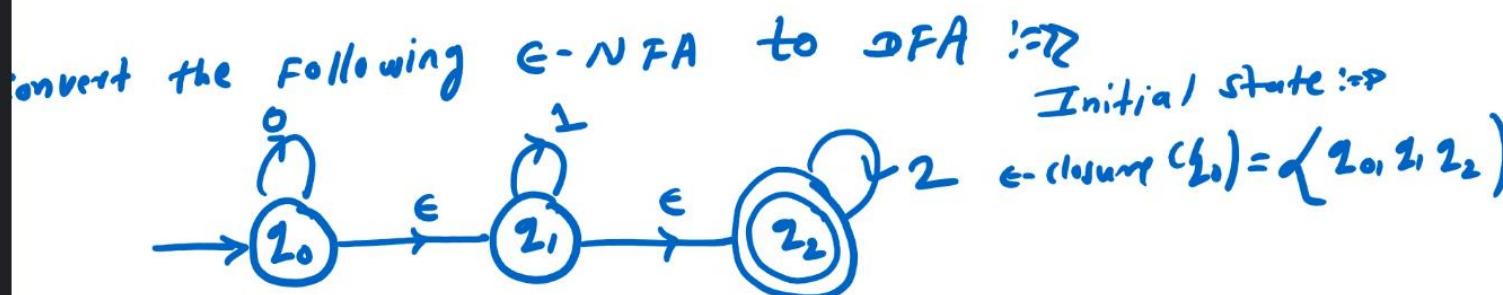
You



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Every subset of states  
of  $\epsilon$ -NFA is a final state in DFA.



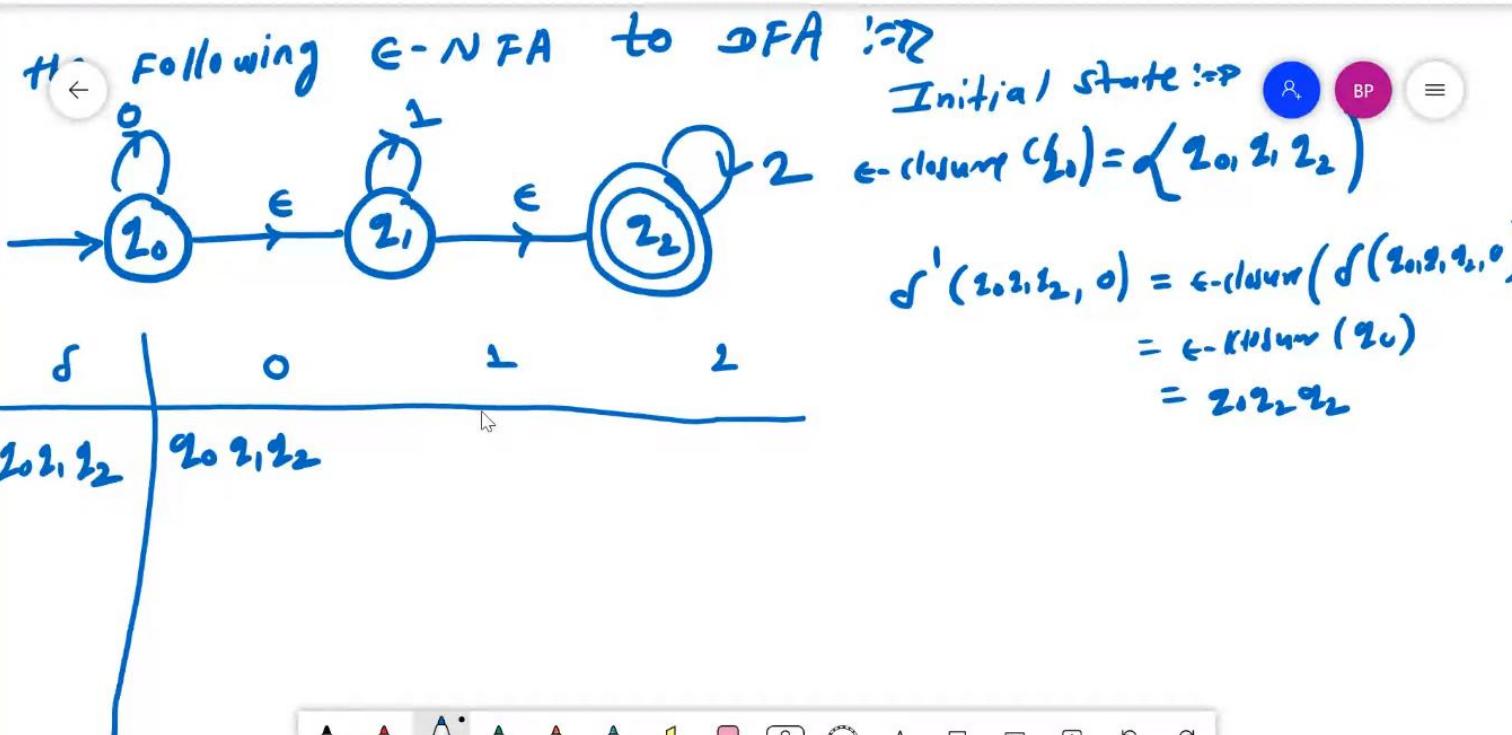
The video conference interface displays a grid of participant thumbnails and names. Participants include:

- Dr. Balu L. Parne SVNIT (host)
- B098 Neelagiri Vijay
- #CAMPUSUG (campus user group)
- B128 ROHAN SVNIT
- B097 GUNJAN SHINDE
- B071 ANGELIN JAYISON ...
- B093 Nehal Jhajharia
- B100 ADITYA RAJ SVNIT
- 38 others
- You (local participant)



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Dr. Balu L. Parne SVNIT

B098 Neelagiri Vijay

#CAMPUSUG

B128 ROHAN SVNIT

B097 GUNJAN SHINDE

B

B071 ANGELIN JAYISON ...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

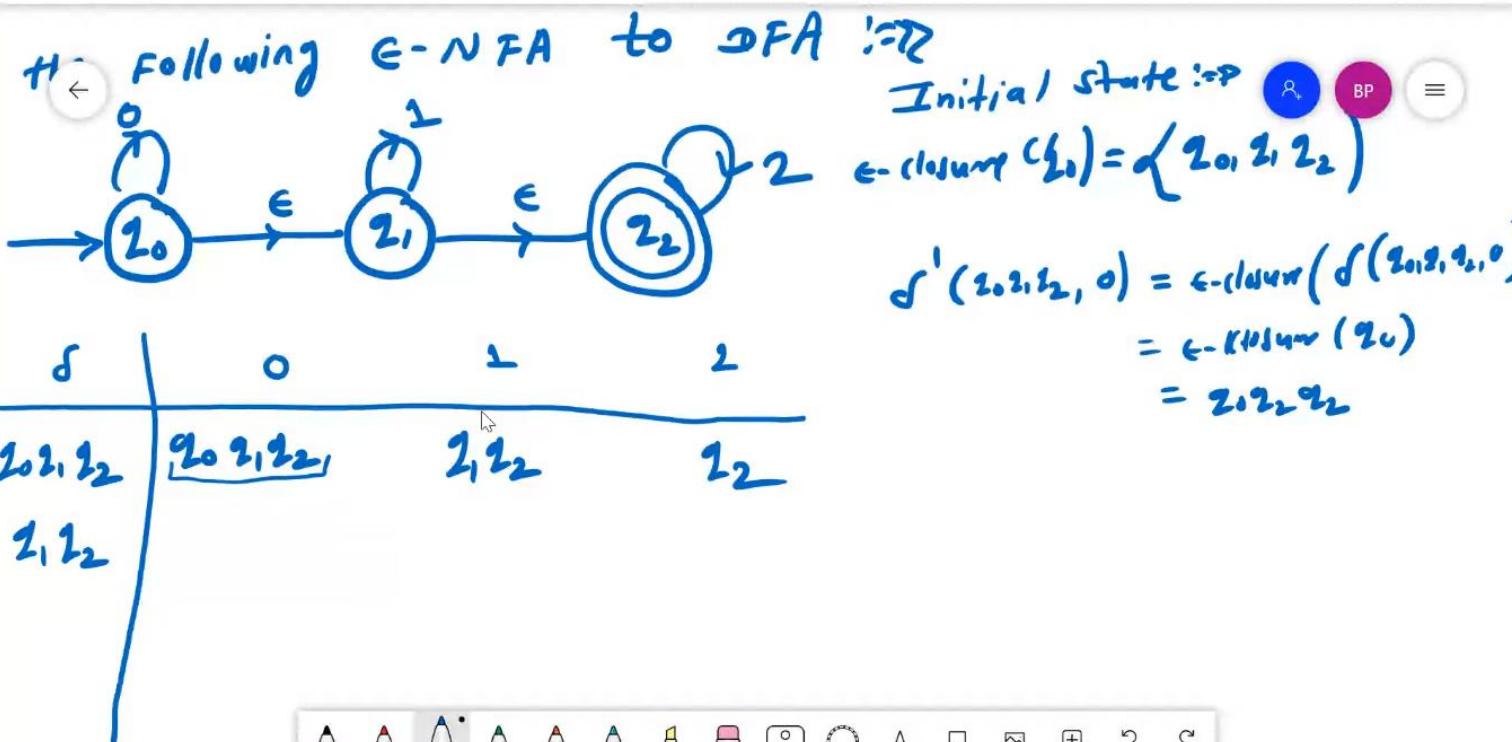
37 others

You



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Dr. Balu L. Parne SVNIT

B098 Neelagiri Vijay

#CAMPUSUG

B128 ROHAN SVNIT

B097 GUNJAN SHINDE

B

B071 ANGELIN JAYISON ...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

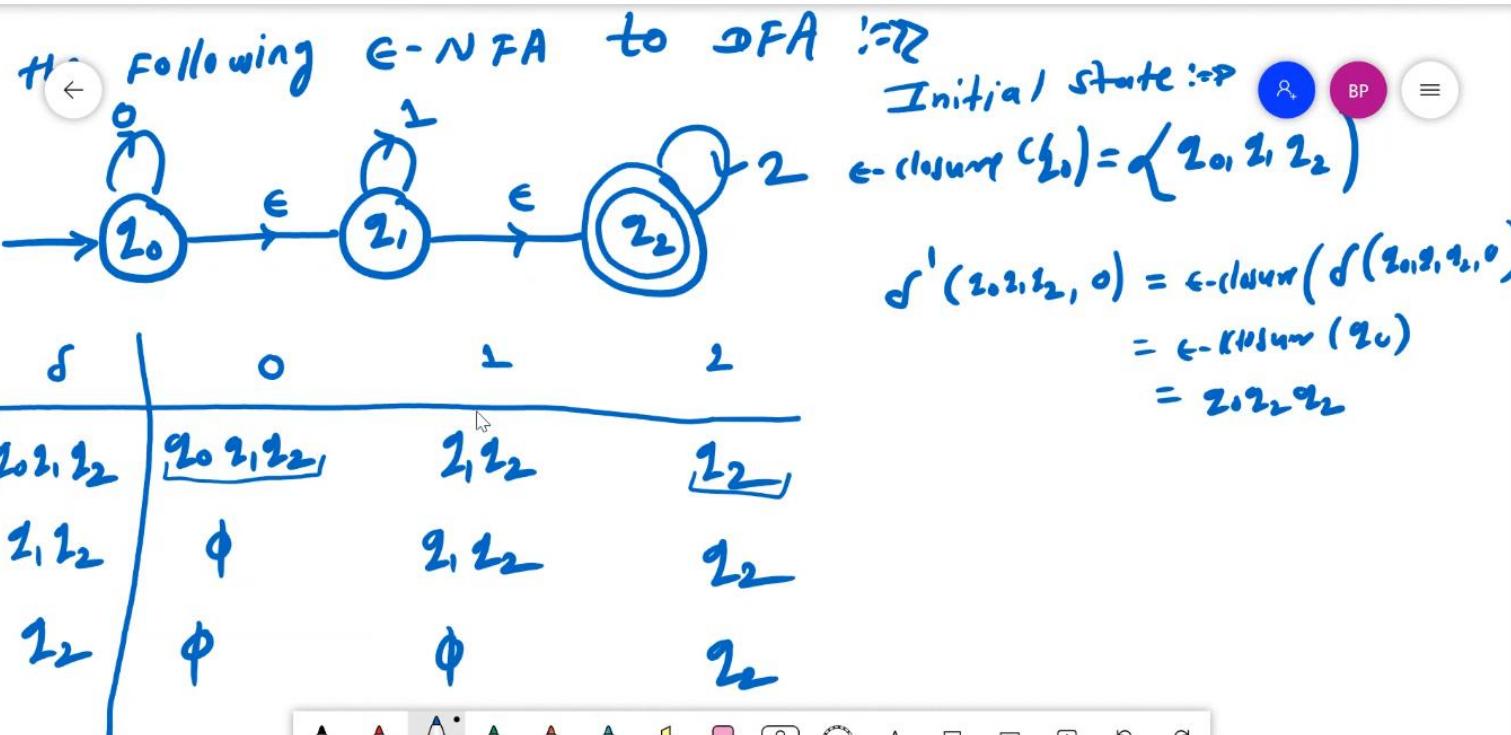
37 others

You



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Dr. Balu L. Parne SVNIT

B098 Neelagiri Vijay

#CAMPUSUG

B128 ROHAN SVNIT

B097 GUNJAN SHINDE

B

B071 ANGELIN JAYISON ...

B093 Nehal Jhajharia

B100 ADITYA RAJ SVNIT

37 others

You



Dr. Balu L. Parne SVNIT is presenting

Microphone on

Microsoft Whiteboard

$$\text{←closure}(z_1) = \delta(z_0, z_1, z_2)$$
$$\delta'(z_0, z_1, z_2, \epsilon) = \text{←closure}(\delta(z_0, z_1, z_2))$$
$$= \text{←closure}(z_0)$$
$$= z_0 z_2 z_2$$

	0	1	2
$z_0 z_1 z_2$	$z_0 z_1 z_2 z_1$	$z_1 z_2$	$z_2$
$z_1 z_2$	$\emptyset$	$z_1 z_2$	$z_2$
$z_2$	$\emptyset$	$\emptyset$	$z_2$

Handwritten notes on the right side of the whiteboard:

- $\text{←closure}(z_1) = \delta(z_0, z_1, z_2)$
- $\delta'(z_0, z_1, z_2, \epsilon) = \text{←closure}(\delta(z_0, z_1, z_2))$
- $= \text{←closure}(z_0)$
- $= z_0 z_2 z_2$

Below the whiteboard is a Windows taskbar showing various application icons and system status.

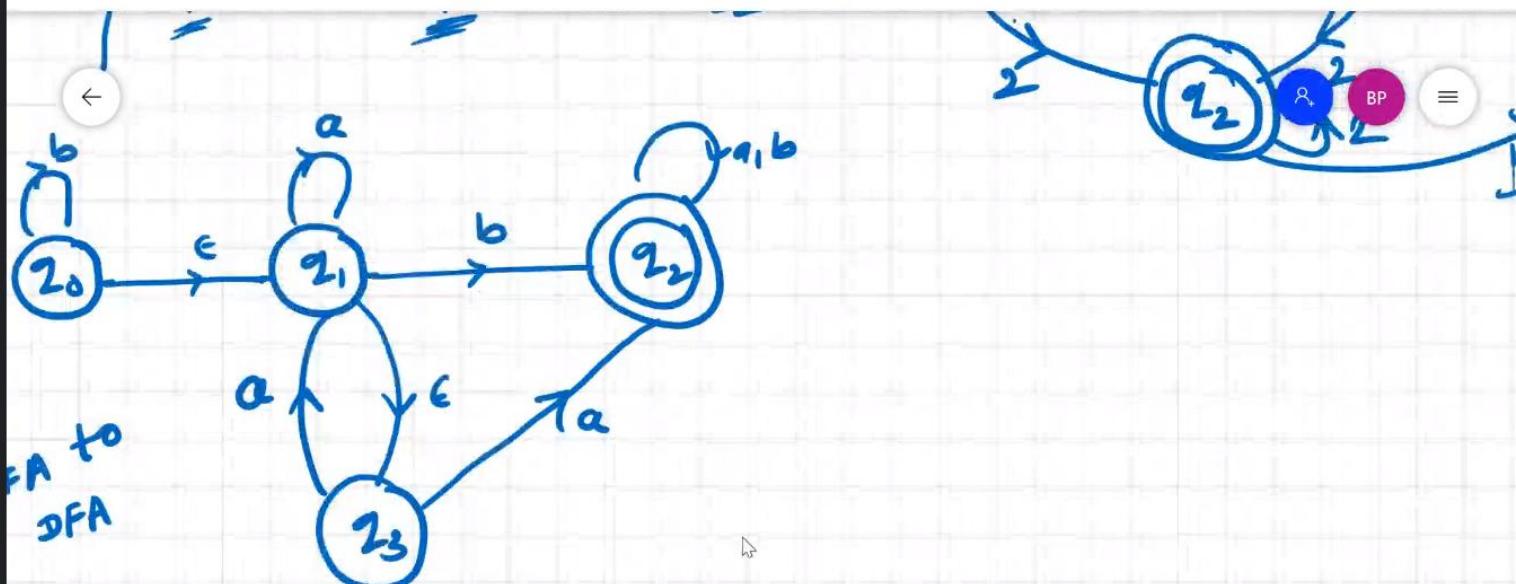
Participants in the video call:

- Dr. Balu L. Parne SVNIT (Moderator)
- B098 Neelagiri Vijay
- #CAMPUSUG
- B128 ROHAN SVNIT
- B097 GUNJAN SHINDE
- B071 ANGELIN JAYISON ...
- B093 Nehal Jhajharia
- B100 ADITYA RAJ SVNIT
- 37 others
- You



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Dr. Balu L. Parne SVNIT

B

B098 Neelagiri Vijay



B128 ROHAN SVNIT



B071 ANGELIN JAYISON ...



B100 ADITYA RAJ SVNIT

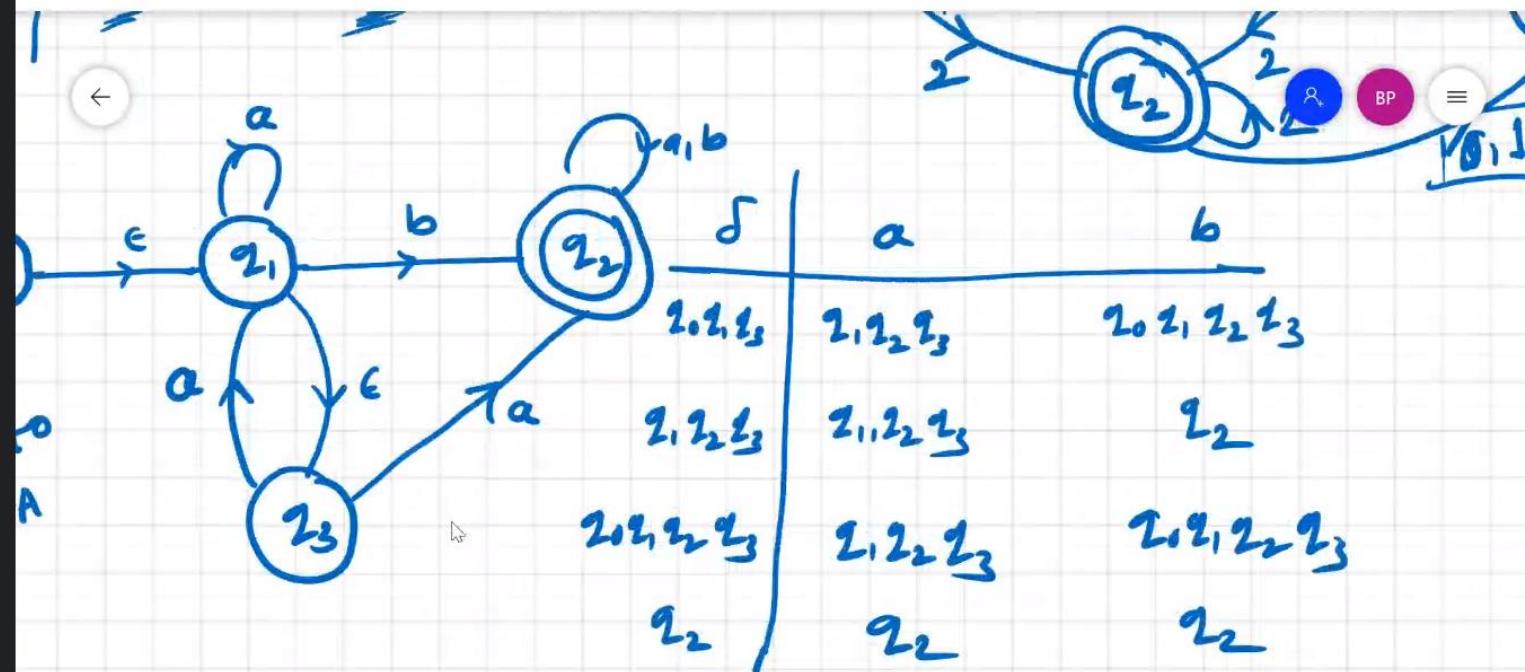


You



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Dr. Balu L. Parne SVNIT

B  
B098 Neelagiri Vijay

#CAMPUS4UG  
B128 ROHAN SVNIT

#CAMPUS4UG  
B097 GUNJAN SHINDE

#CAMPUS4UG  
B071 ANGELIN JAYISON ...

#CAMPUS4UG  
B109 CH ADITHYA SVNIT

B100 ADITYA RAJ SVNIT

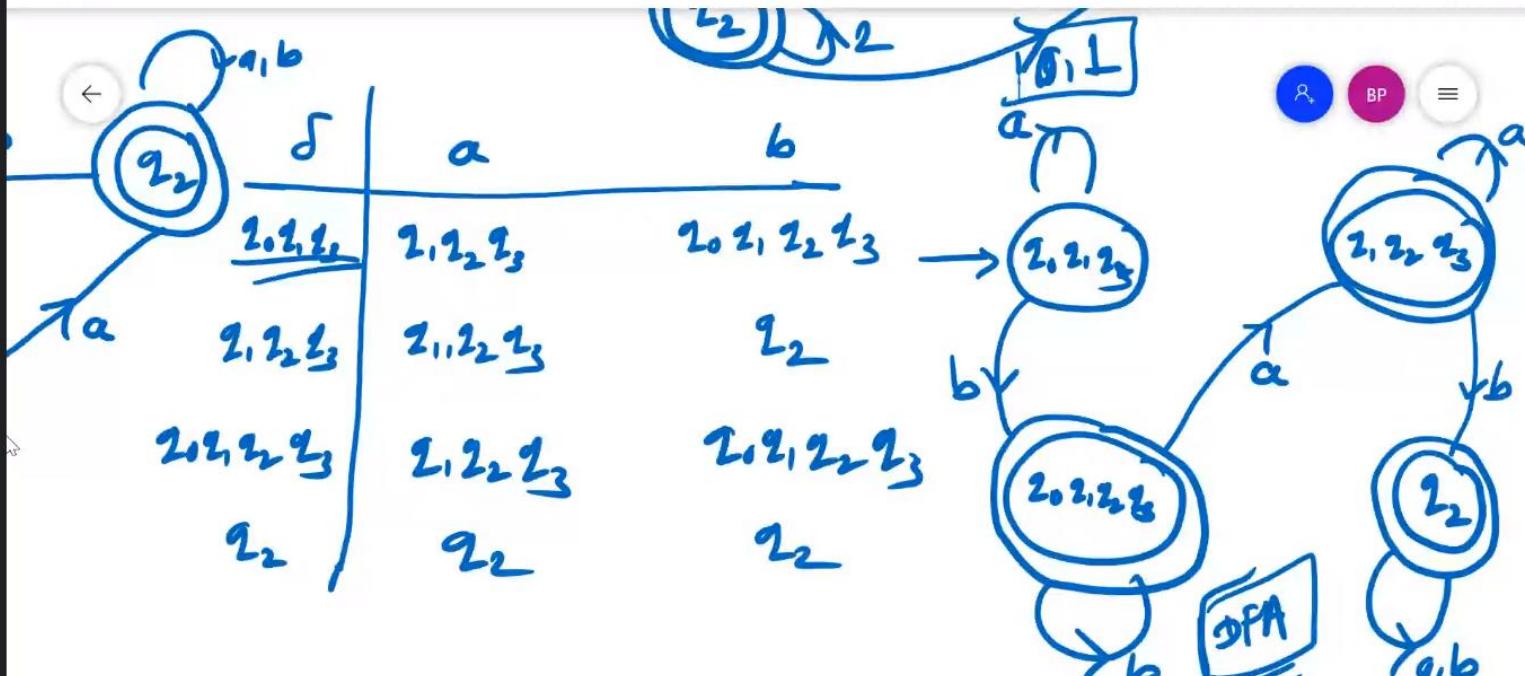
B  
38 others

You



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Dr. Balu L. Parne SVNIT

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B098 Neelagiri Vijay

#CAMPUS4UG  
B128 ROHAN SVNIT

B097 GUNJAN SHINDE

B  
B071 ANGELIN JAYISON ...

#CAMPUS4UG  
B109 CH ADITHYA SVNIT

B100 ADITYA RAJ SVNIT

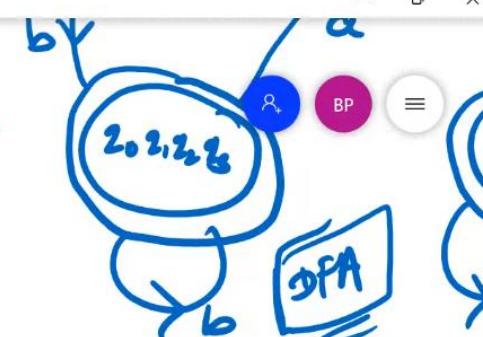
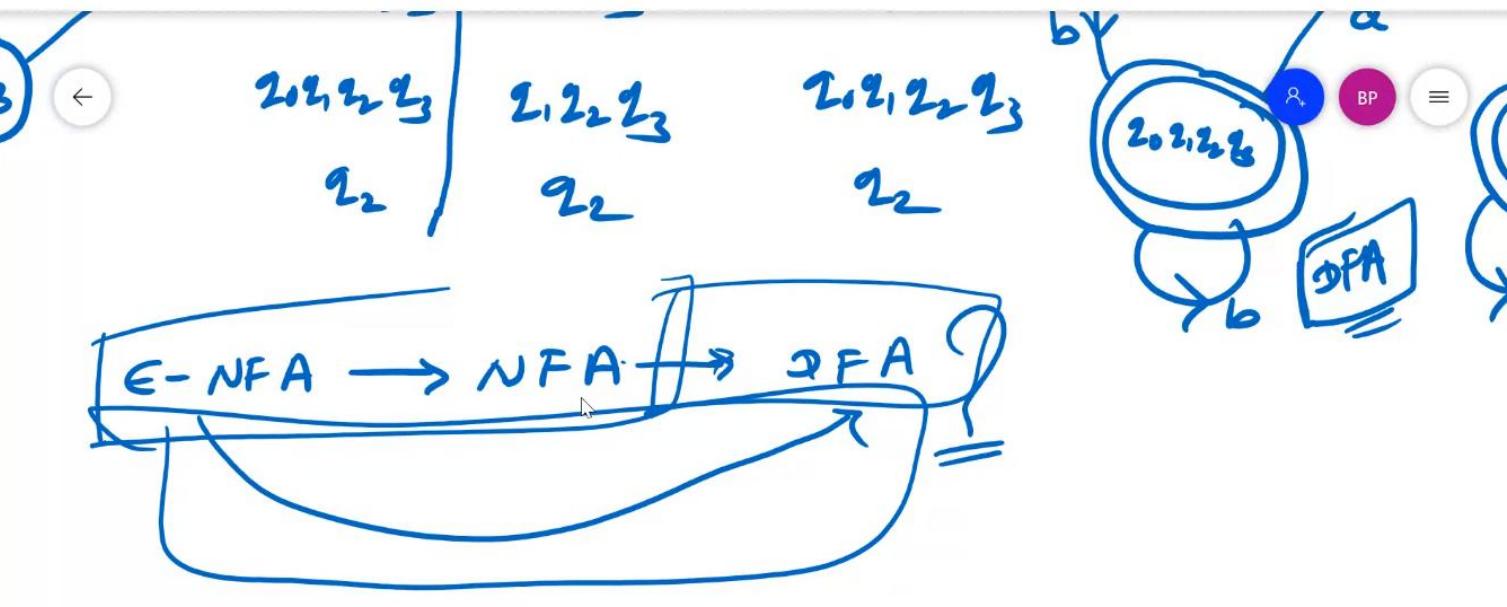
B  
37 others

You



Dr. Balu L. Parne SVNIT is presenting

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12:27 PM | Div-B | CS208 | AFL Theory Class



A grid of video conference participants. The top row includes the presenter (Dr. Balu L. Parne SVNIT) and a student (B098 Neelagiri Vijay). The second row includes students (B128 ROHAN SVNIT, B097 GUNJAN SHINDE). The third row includes students (B071 ANGELIN JAYISON, B109 CH ADITHYA SVNIT). The fourth row includes student (B100 ADITYA RAJ SVNIT) and others (37 others). The bottom row shows the participant "You".

12:27 PM  
2/8/2022

ENG  
IN