TIMED AUTOMATA

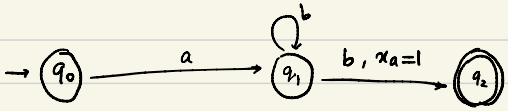
LECTURE 9

GOALS OF TODAY'S LECTURE:

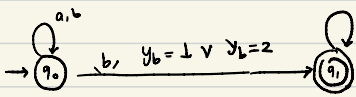
- 1. Examples of determinizing E.C.A.
- 2. Expressive power among different classes of ECA and T.A.

Determinize the following ECA:

1)



2)



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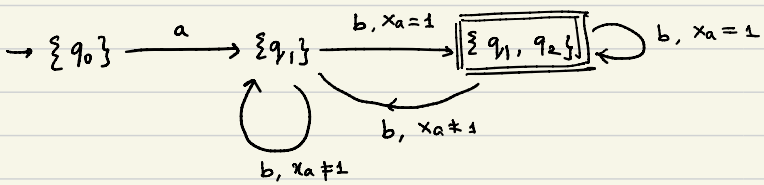
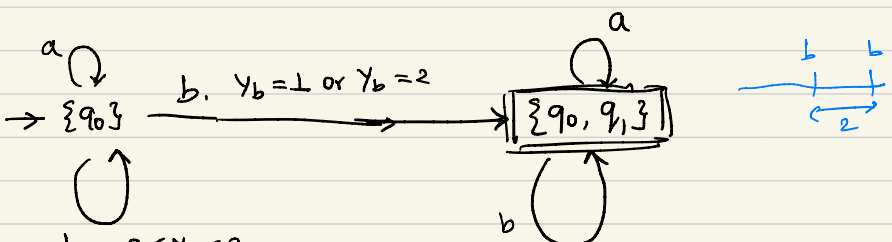
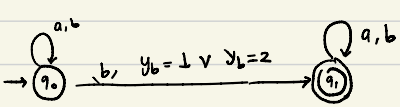
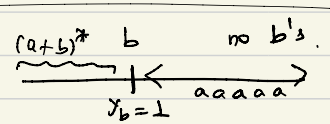
1)

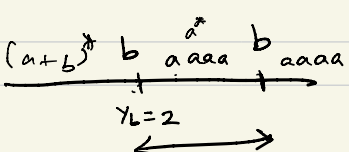


2)

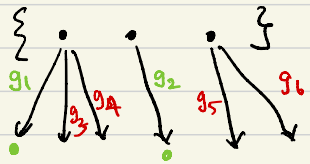






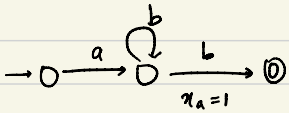


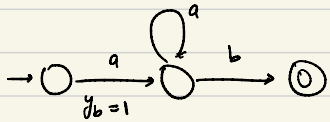
Recalling the subset idea:

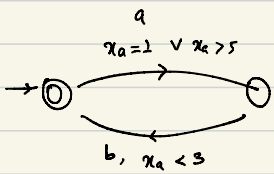


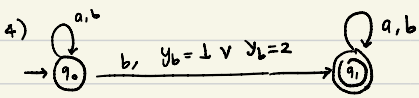
$$g_1 \wedge g_2 \wedge !g_3 \wedge !g_4 \wedge !g_5 \wedge !g_6.$$

Converting ECA to timed automata:

1) 

2) 

3) 

4) 

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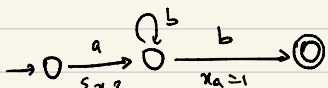
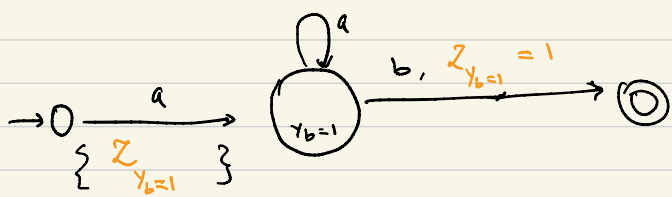
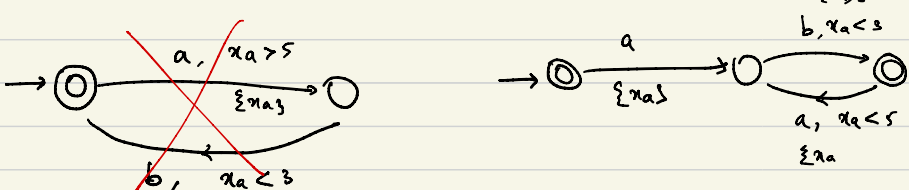
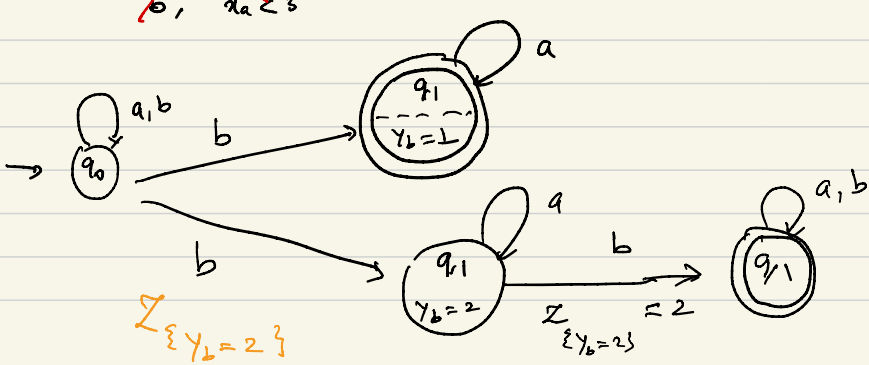
1) 

T.A. (Add reset of x_a to edges on 'a' over all letters)

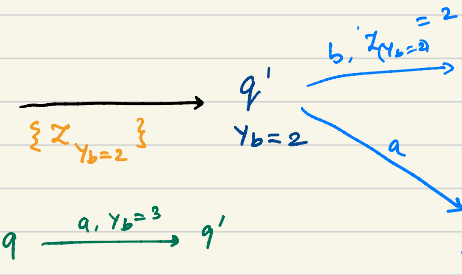
2) 

3) 

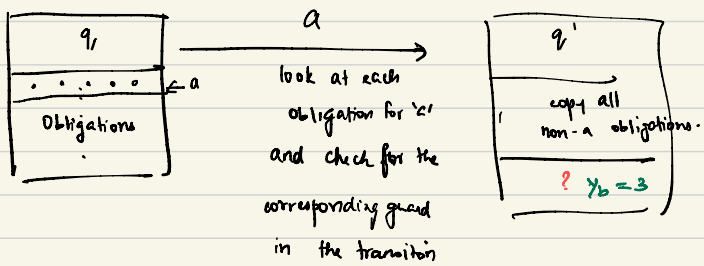
4) 

Converting EPA to NTA:

General idea: $\xrightarrow{y_b = 2}$ q'



States of TA: $q \xrightarrow{a,\ y_b=3} q'$



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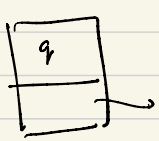
* If obligation is $y_b = \perp$, then no 'b' transition should exist from that state.

* What are accepting state?:

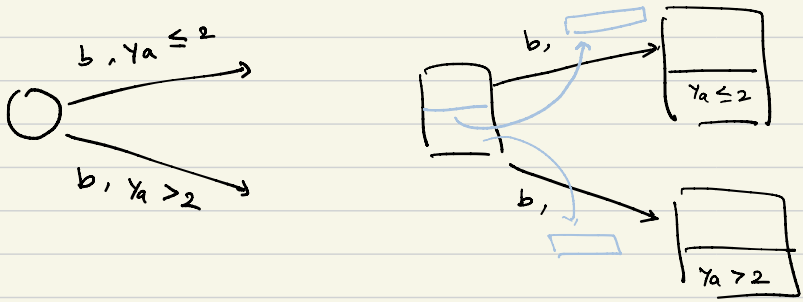


$q \in F$ (in the EPA)

only obligations are of the form $y_b = \perp$

Question: In this conversion from EPA to T·A:

will a deterministic EPA be converted to a det. T·A.?



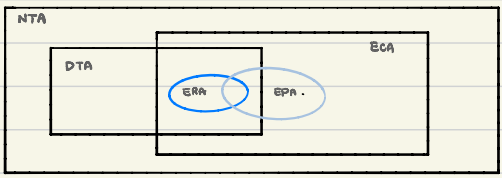
- The determinism existing in the EPA gets destroyed by this construction.

Question: Compare the languages accepted by EPA and det. TA.

I. EPA $\subseteq$ DTA ? No:

Construct a language recognized by an EPA, but not by a Det. TA.

Expressive Power of different classes:



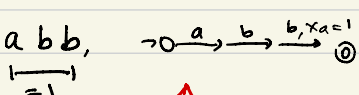
1) ERA $\subseteq$ DTA:

Without $\perp$ guards: just adding $\{x_a\}$ in every transition on 'a' works.

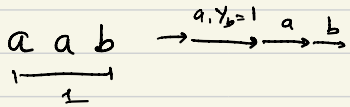
- ERA $\rightarrow$ Det. ERA $\rightarrow$ apply this transformation $\rightarrow$ DTA

- We worry about $\perp$ later.

2) ERA $\not\subseteq$ EPA



3) EPA $\not\subseteq$ ERA



3) DTA $\not\subseteq$ EPA ($\exists$ L in DTA which is not EPA recog.)

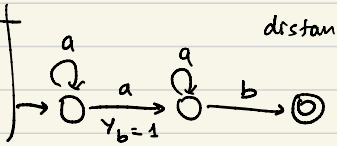
4) EPA $\not\subseteq$ DTA — $\exists$ a L which EPA but not by DTA

5) DTA $\not\subseteq$ ECA — $\exists$ L in DTA which is not ECA recog.

6) ECA $\not\subseteq$ DTA — $\exists$ L in ECA which is not DTA recog.

5) b b b (=1)

4) $a^k b$ s.t. there exists some 'a' which is at distance 1 from 'b'.



There is no DTA accepting this language

7) ECA $\not\subseteq$ EPA $\cup$ ERA

a b b (=1) $\cup$ a a b (1)

Summary of ECA:

- Determinizable class
- We have compared expressive power

$\mathcal{L}(\mathcal{B}) \subseteq \boxed{\mathcal{L}(\mathcal{A})}$ (ECA)

↓ determinize

↓ complement

↓ take intersection with $\mathcal{L}(\mathcal{B})$