

LECTURE 10

GOALS:

- Event-Clock Automata -> Timed Automata





EPA to NTA: Given EPA A= (Q, ≥, Ro, △, F). the equivalent NTA is given as follows: det Φ_{A} be the set of all atomic clock constraints appearing in edges of A. Atomic clock constraints: $y_a = 1$ or $y_a \sim c$ $\sim c^3 < c > = 3$ $(q, \psi) \qquad q \in Q$ $\psi \subseteq \Phi_A$ - statu: - Initial statu: (qo, y) qo c Qo y does not contain a constraint of the form (yarc) ya = { ya=1 laces - Accepting state: (9,41) 9 c F yn ⊆ ² ya=1latz3 - Clochs: For every 4 := (ya~c) e \$ A, keep a clock Zyn

- Transitions: $(q, y_1) \xrightarrow{a, q} (q', y'_1)$ if $(q, a, \varphi, q') \in \Delta$ $q \xrightarrow{q, \varphi} q'$ incm - છ Constraint ya=1 does not appear in 41 - ii) g: Conjunction of Zyano tor every yance 41 -tii) For all 6 = a, if a constraint involving y appears in the then it appears in the then it -127 -v) Each atomic constraint of 4 appears in 41'. -vi) For each 'b', and for ~ equal to > or >, Xybre appears in result condition Riff constraint your is present in y. -vii) For each 'b', and for ~ equal to < or <, Zy appears in rest condition R its constraint y ~c is prount in y and either b=a or the constraint y we is not present in Y.

Part 3. ECA to NTA: Combination of both method Question: -1. Does ERA to T.A. preserve determinism? Yes. -2. DOU EPA to T.A. preverve determinism? 1). ERA to T.A. - quards are maintained as they are in the FKA. This will ensure that if we start with a DERA, we will get a D.T.A.





EPA & DTA $\rightarrow \bigcirc^{\mathbf{a}} \xrightarrow{\mathbf{a}} \bigcirc^{\mathbf{a}} \xrightarrow{\mathbf{a}} \bigcirc^{\mathbf{a}} \xrightarrow{\mathbf{b}} \bigcirc$ There is no DTA for this language. Intuitively, we cannot guess the a' deterministically for which the b is at distance 1. Exercise: Prove this formally.

Summary:
- Event - clock automata.
- Xe : records time since last event
- Ya: predicts time to rest in went
- Determinized
- Closed under boolean operations:
Inclusion:
$$\angle(B) \subseteq \angle(A)$$

1 1
7.A E-CA
Let A^{C} be the EOB for $\angle(A)$
- $\angle(B) \subseteq \angle(A)$ (=> $\angle(B) \cap \angle(A^{C}) = \phi$
 $(=) \angle(B) \cap \angle(D) = \phi$
Lo NTA.
- Devidable if A is an ECA.
- Expressive power of the modul.