Metropolis

A modern beamer theme

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Center for modern beamer themes

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Introduction

Background

Timed Automata

- A timed automaton [1] is a finite state automaton extended with a finite set of real-valued clocks.
- Upon an input, the selection of next state is based not only on the input symbol but also on the time of the current symbol with respect to the formerly read symbols.

Example: Consider a simple timed automaton in Figure 1. This automaton accepts an input sequence 'a' followed by 'b' such that, there is 2 units of time difference between any two consecutive a's and b's.

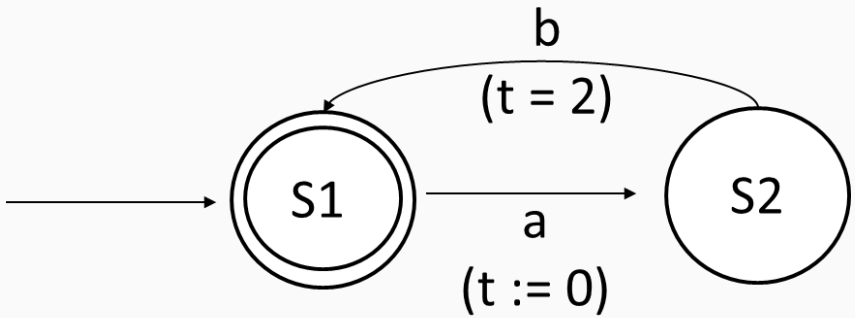


Figure 1: Simple Timed Automaton

Synthesis Of Timed Automata From Scenarios

Synthesis Of Timed Automata From Scenarios

- Constructing a time annotated graph from scenarios, and
- Constructing a timed automaton from time annotated graph.

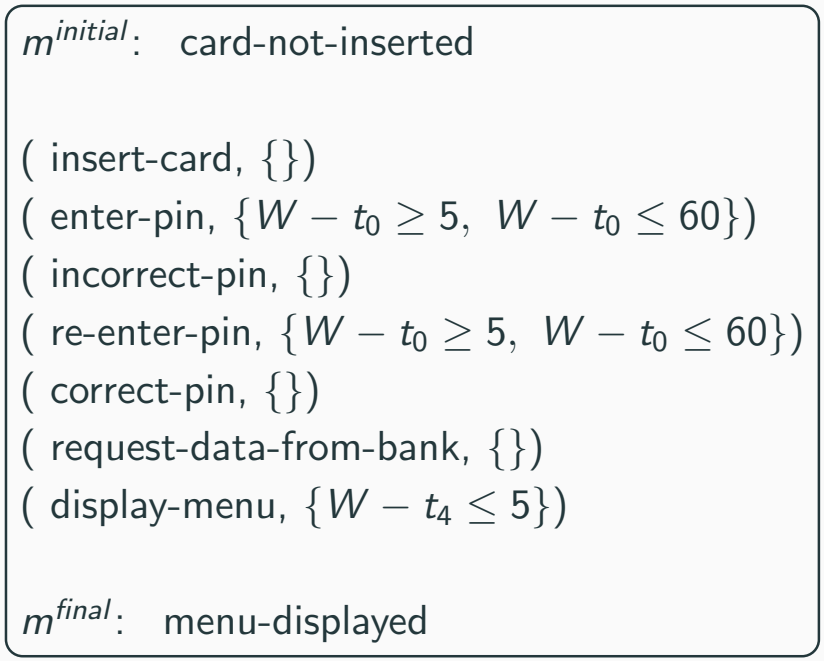
Constructing A Timed Automaton From Time Annotated Graph

1. Determining the required number of clocks,
2. Adding clock resets,
3. Replacing the time annotations with the clock constraints

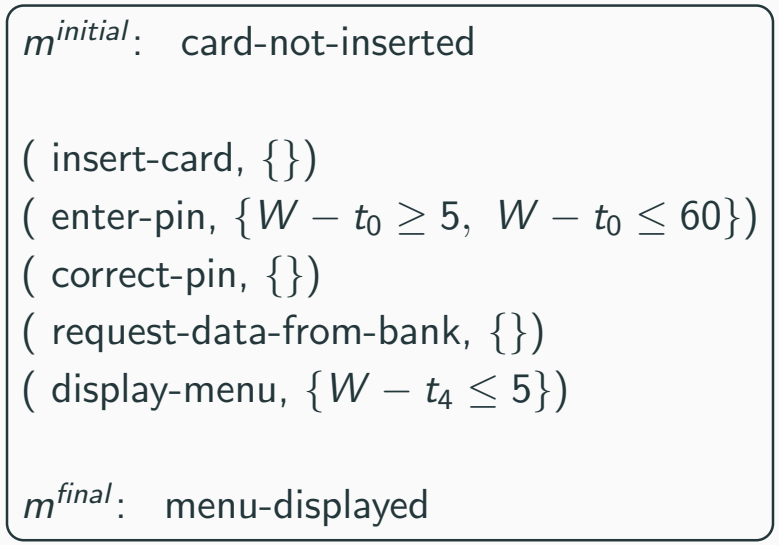
Constructing A Timed Automaton From Time Annotated Graph

content...

Constructing A Timed Automaton From Time Annotated Graph



TES of Scenario 1



TES of Scenario 2

Figure 2: Timed Event Sequences of the ATM

Constructing A Timed Automaton From Time Annotated Graph

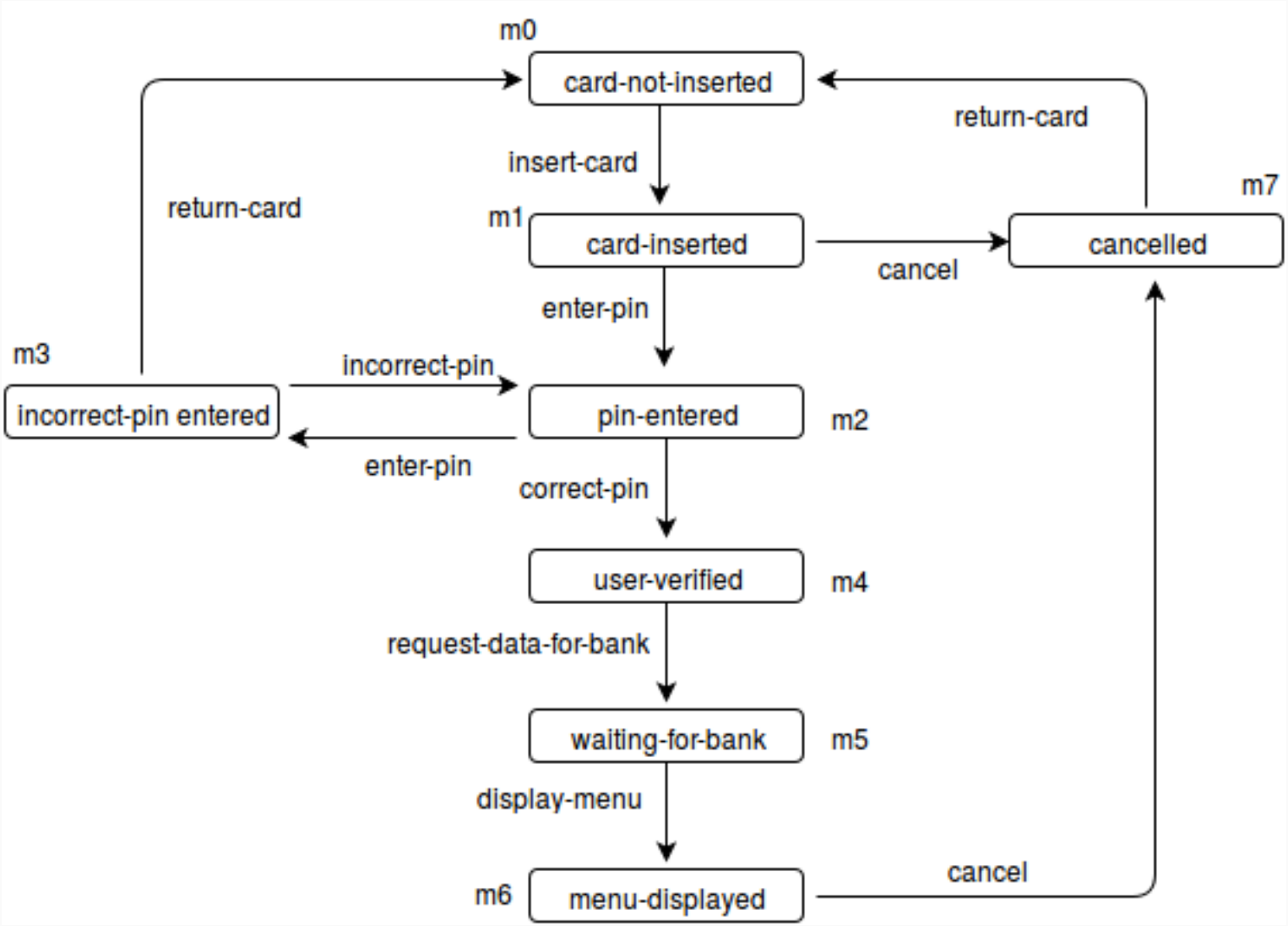


Figure 3: Mode Graph for ATM

Constructing A Timed Automaton From Time Annotated Graph

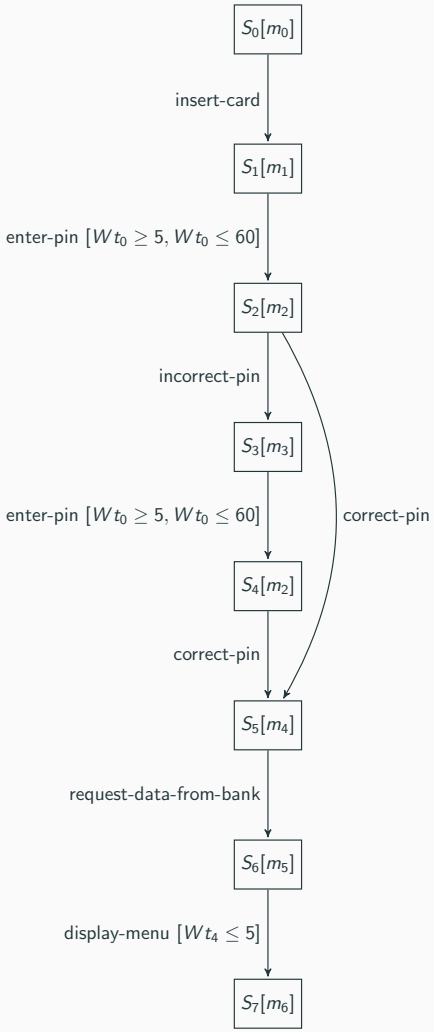


Figure 4: Time annotated graph synthesized from two TES in Figure **??**

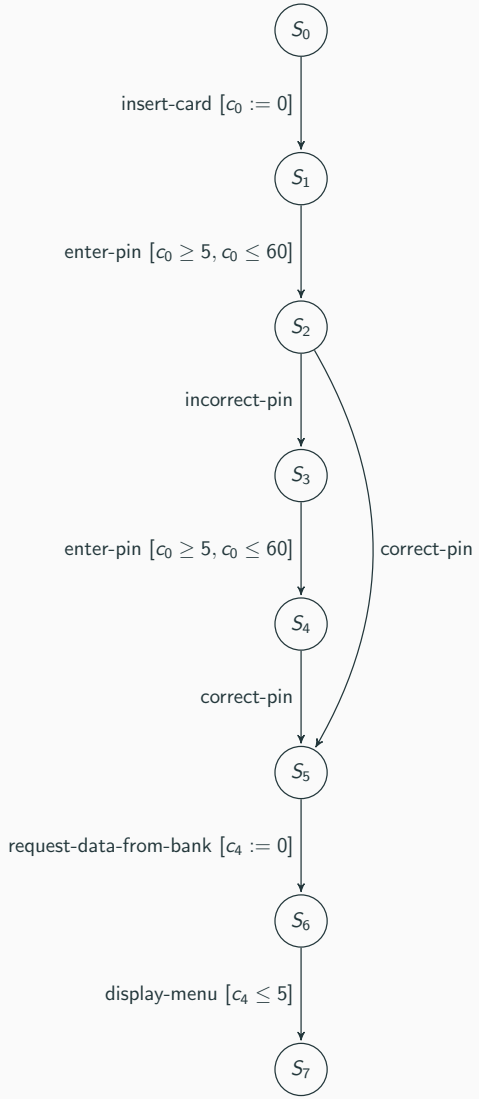


Figure 5: Timed automaton constructed from time annotated graph

Optimal Clock Allocation of Timed Automata

Optimal Clock Allocation of Timed Automata

- Liveness analysis
- Clock allocation

Liveness Range Analysis

- **clock_ref**: $clock\_ref(r)$ is the set of clocks which are referred to in the clock constraints on r.
- **born**: $born(r)$ identifies a clock that is reset on r whose value can be used on some transition reachable from r.
- **active**: $active(r)$ identifies clocks that are "alive" on r (i.e., their values may be subsequently used). Notice that $born(r) \subseteq active(r)$.
- **needed**: Maps transition r to $active(r) \cup clock\_ref(r)$.

Liveness Range Analysis Example

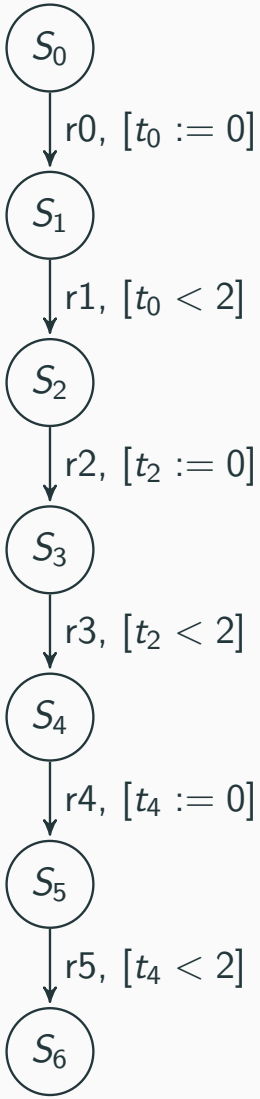


Figure 6: A simple timed automaton

Table 1: *born* and *active* values

Transition	Born	Active
r_0	$\{0\}$	$\{0\}$
r_1	ϕ	ϕ
r_2	$\{2\}$	$\{2\}$
r_3	ϕ	ϕ
r_4	$\{4\}$	$\{4\}$
r_5	ϕ	ϕ

ModeGraph

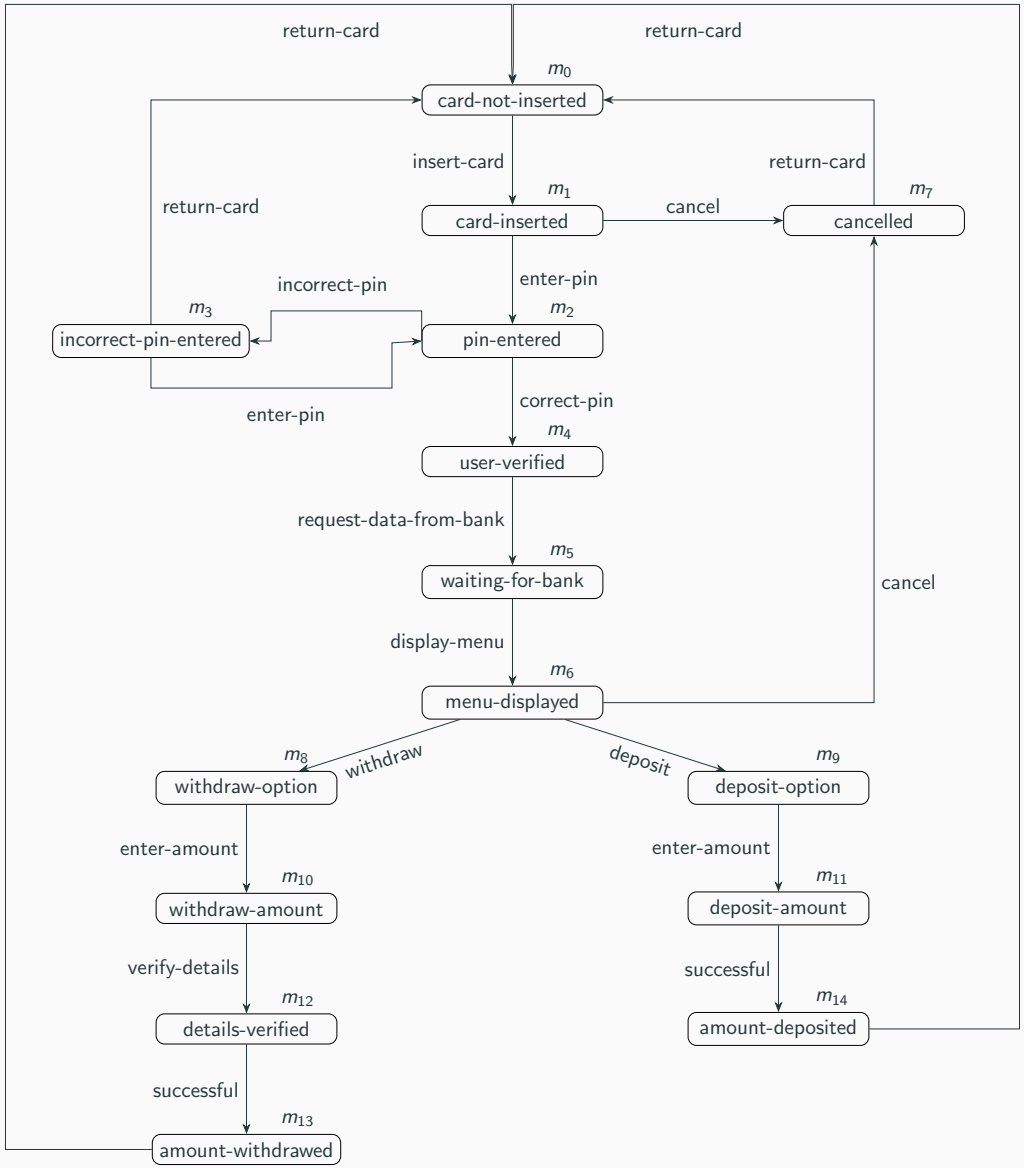


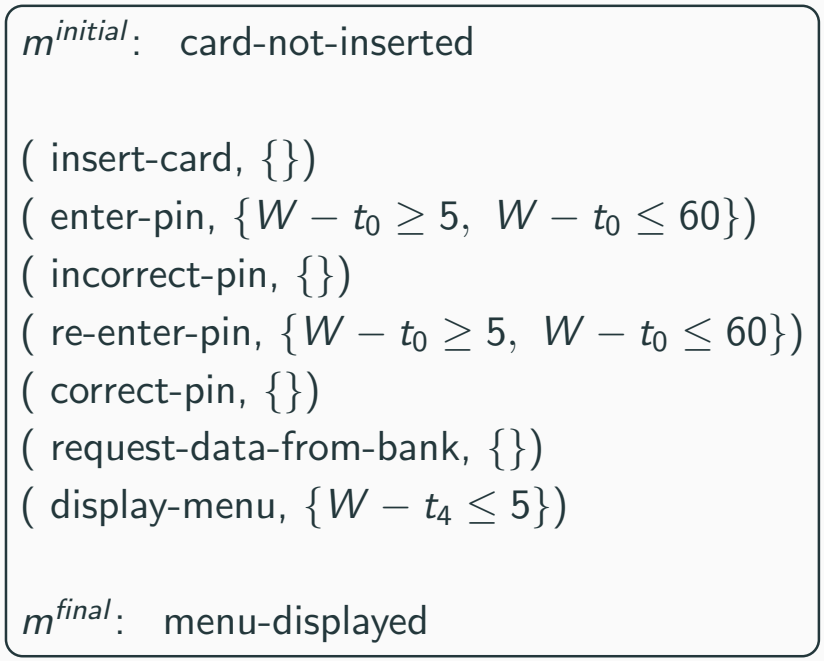
Figure 7: Mode graph of the ATM

Case Studies

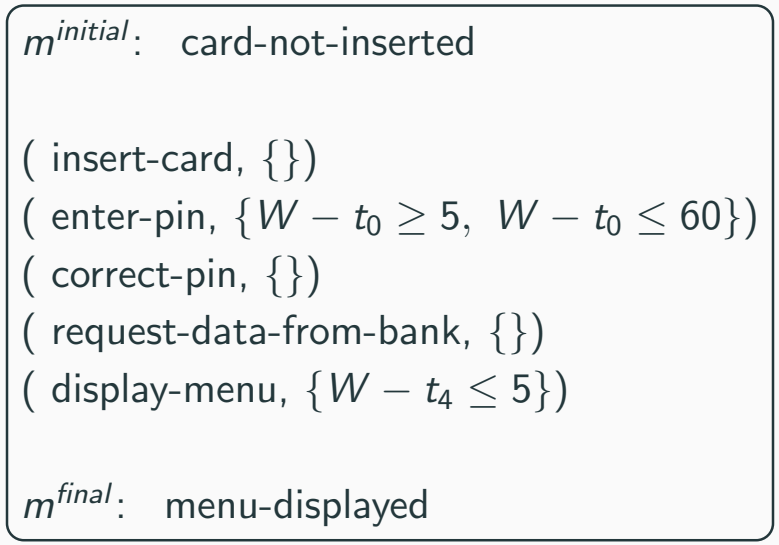
Automated Teller Machine (ATM)

Explain original scenario

Automated Teller Machine (ATM)



TES of Scenario 1



TES of Scenario 2

Figure 8: Timed Event Sequences of the ATM

Automated Teller Machine (ATM)

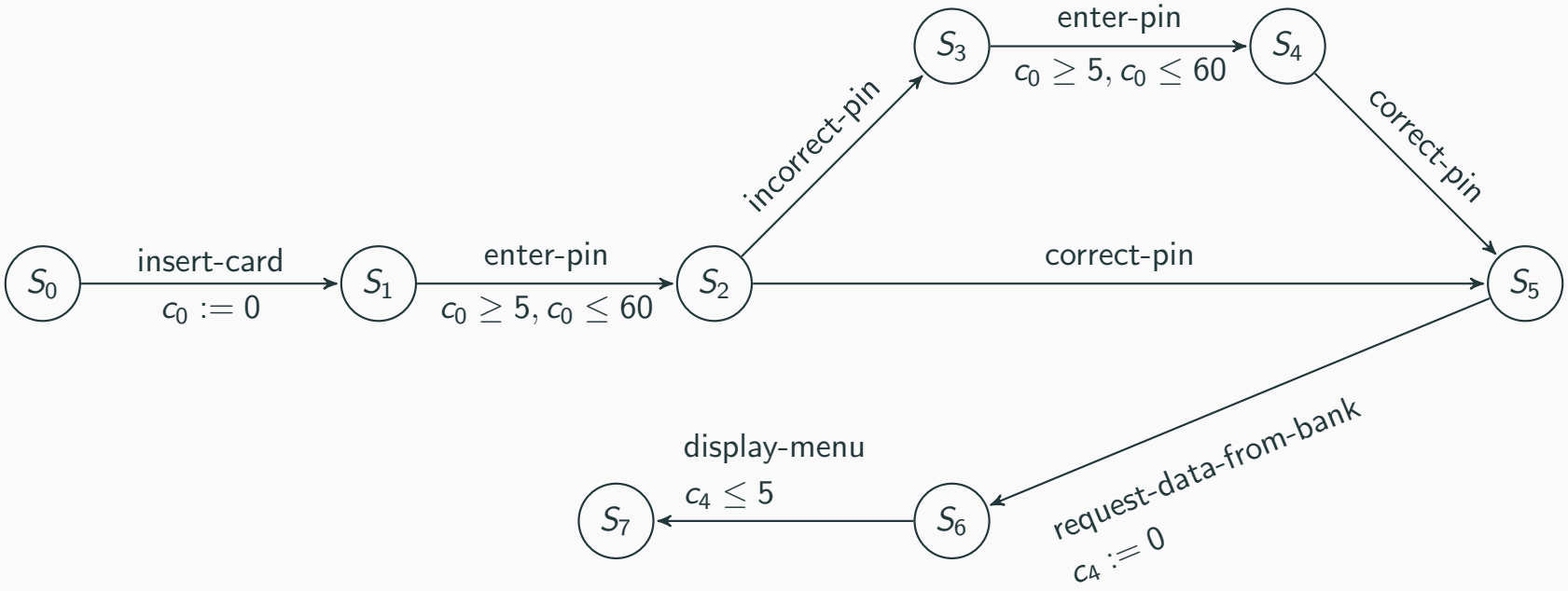
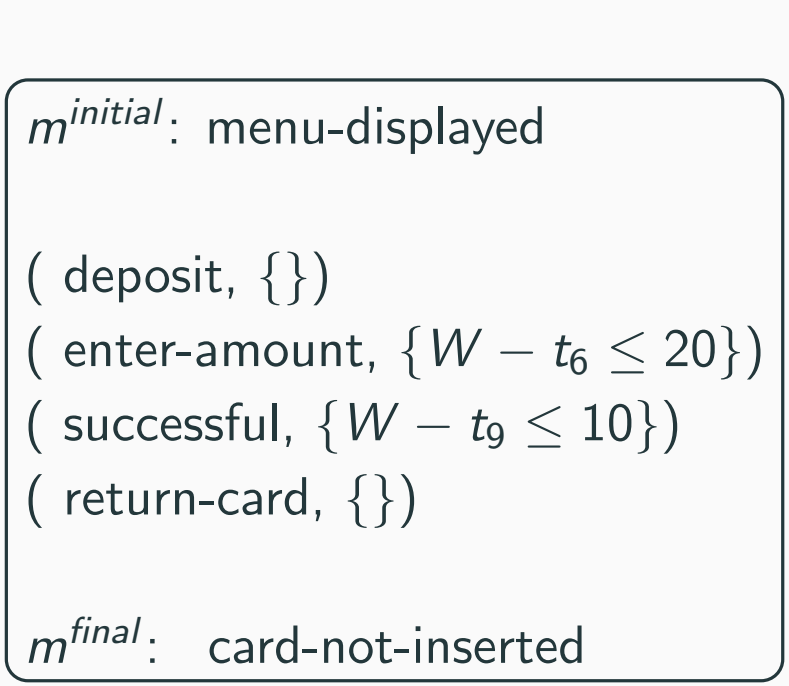


Figure 9: Timed automaton synthesized from Scenario 1 and Scenario 2

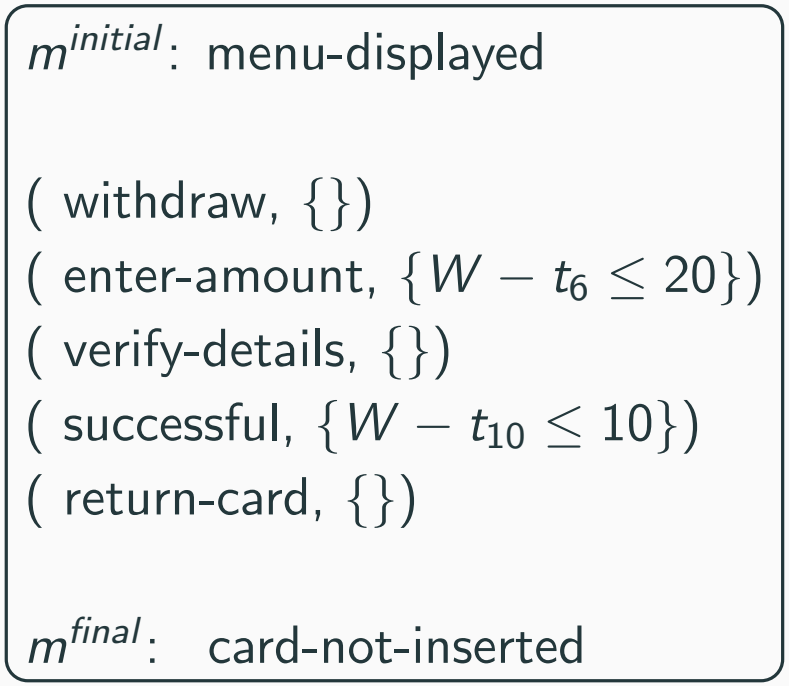
Automated Teller Machine (ATM)

Explain extended scenario

Automated Teller Machine (ATM)



TES of Scenario 3



TES of Scenario 4

Figure 10: Timed Event Sequences of the ATM with withdraw and deposit option

Automated Teller Machine (ATM)

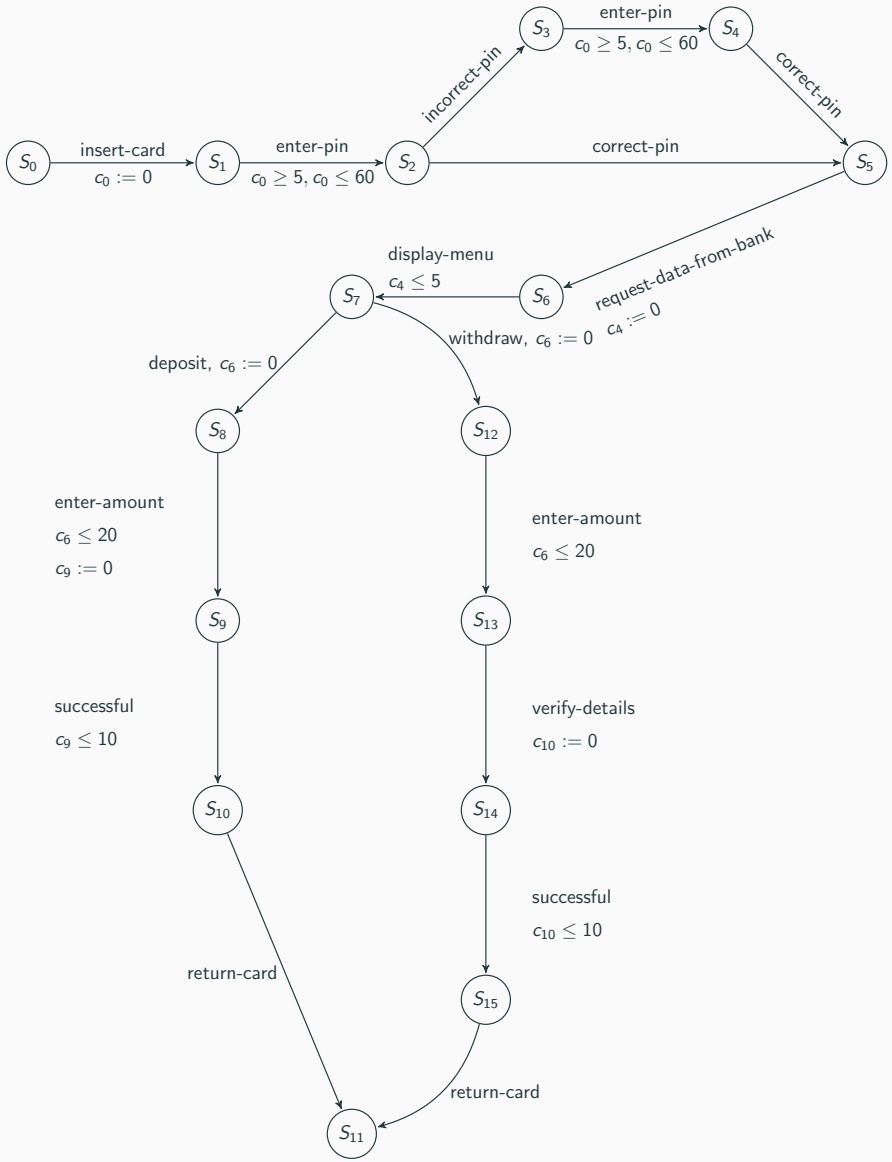


Figure 11: The synthesized timed automaton of the ATM

Light Control System

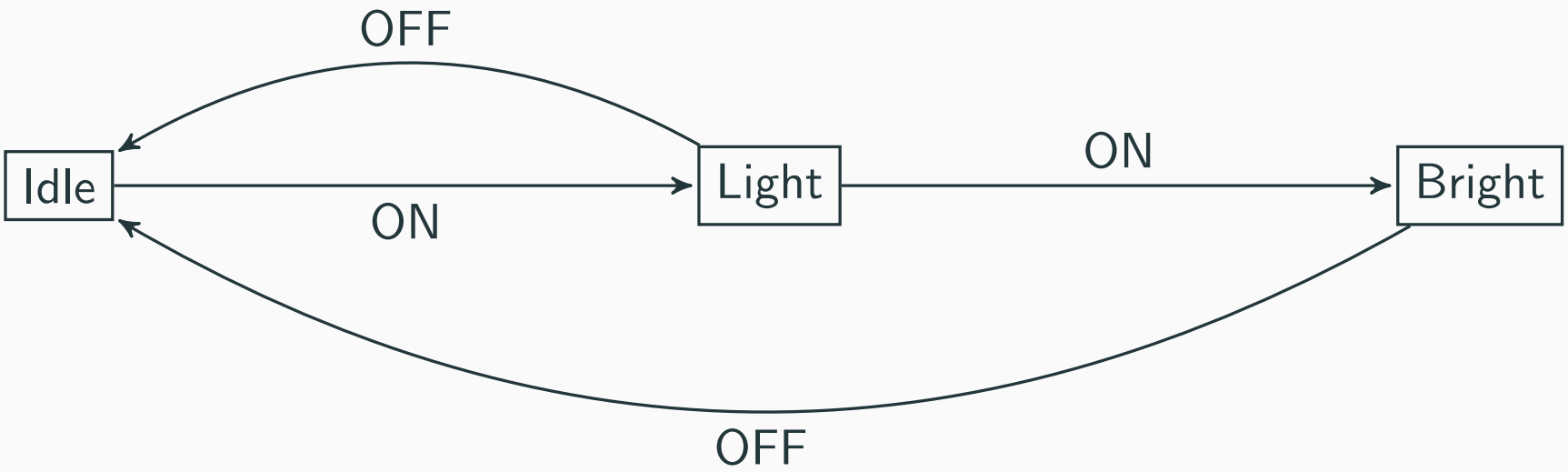


Figure 12: Mode graph of the Light Control System

Light Control System

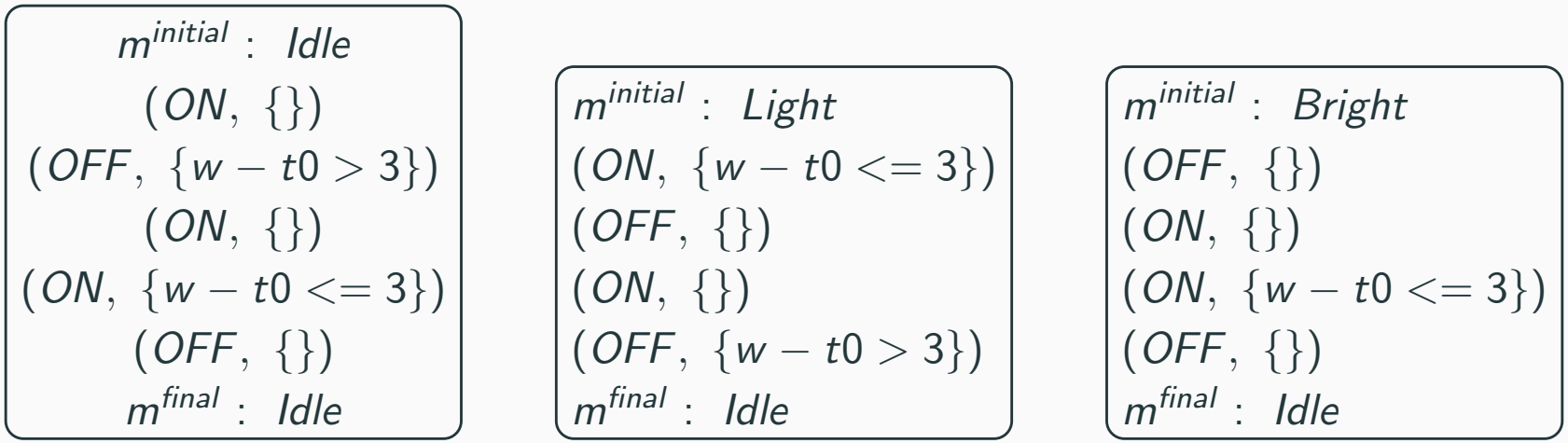


Figure 13: Timed Event Sequences of the Light Control System

Light Control System

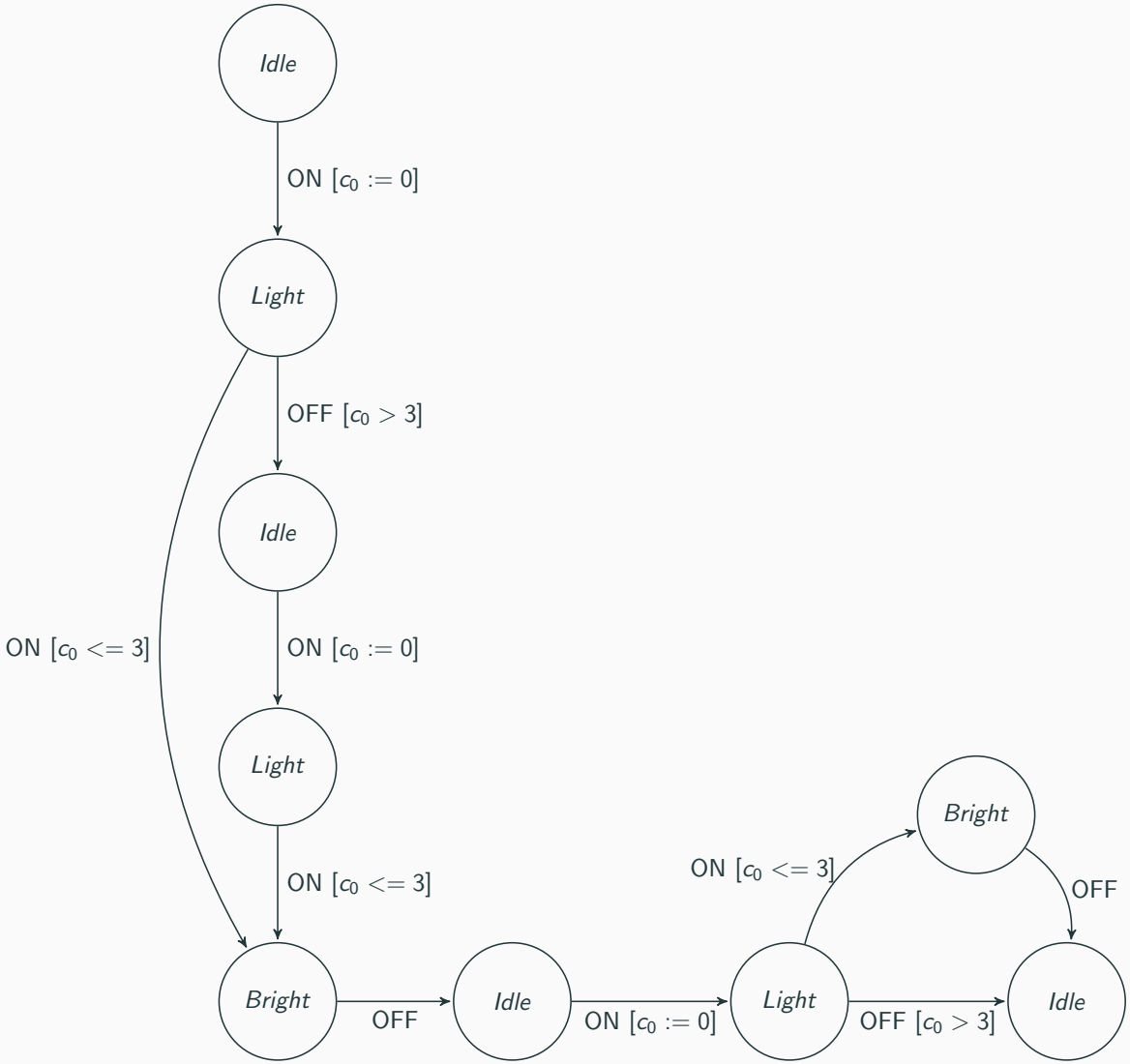


Figure 14: Timed automaton of the Light Control System

Traffic Light

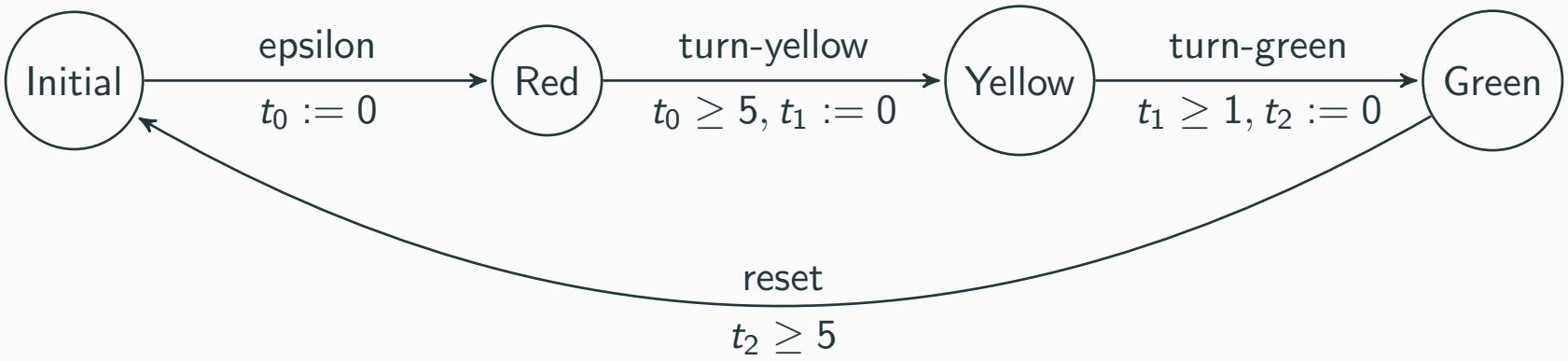


Figure 15: Timed automaton of the Traffic Light

Traffic Light

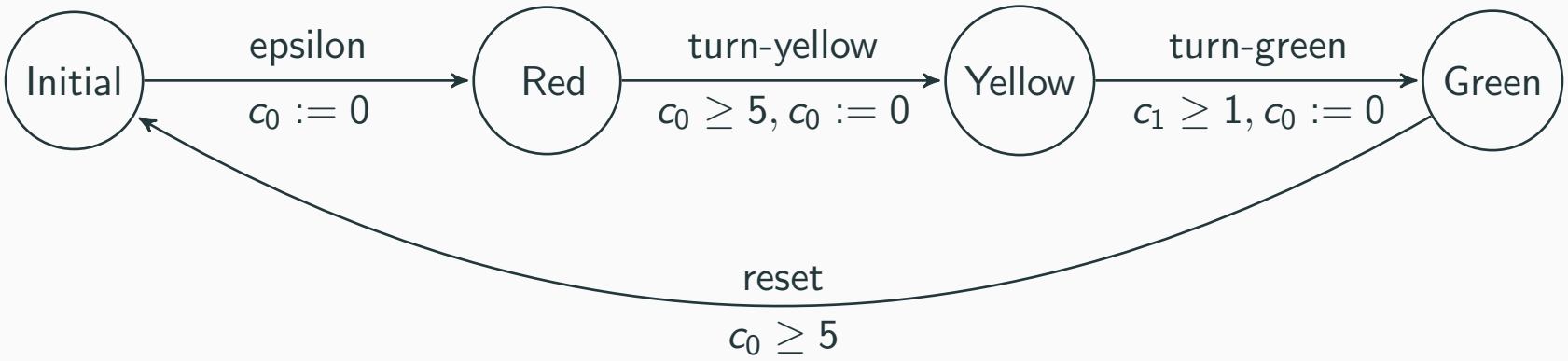


Figure 16: The optimally allocated timed automaton of the Traffic Light

CSMA/CD Protocol

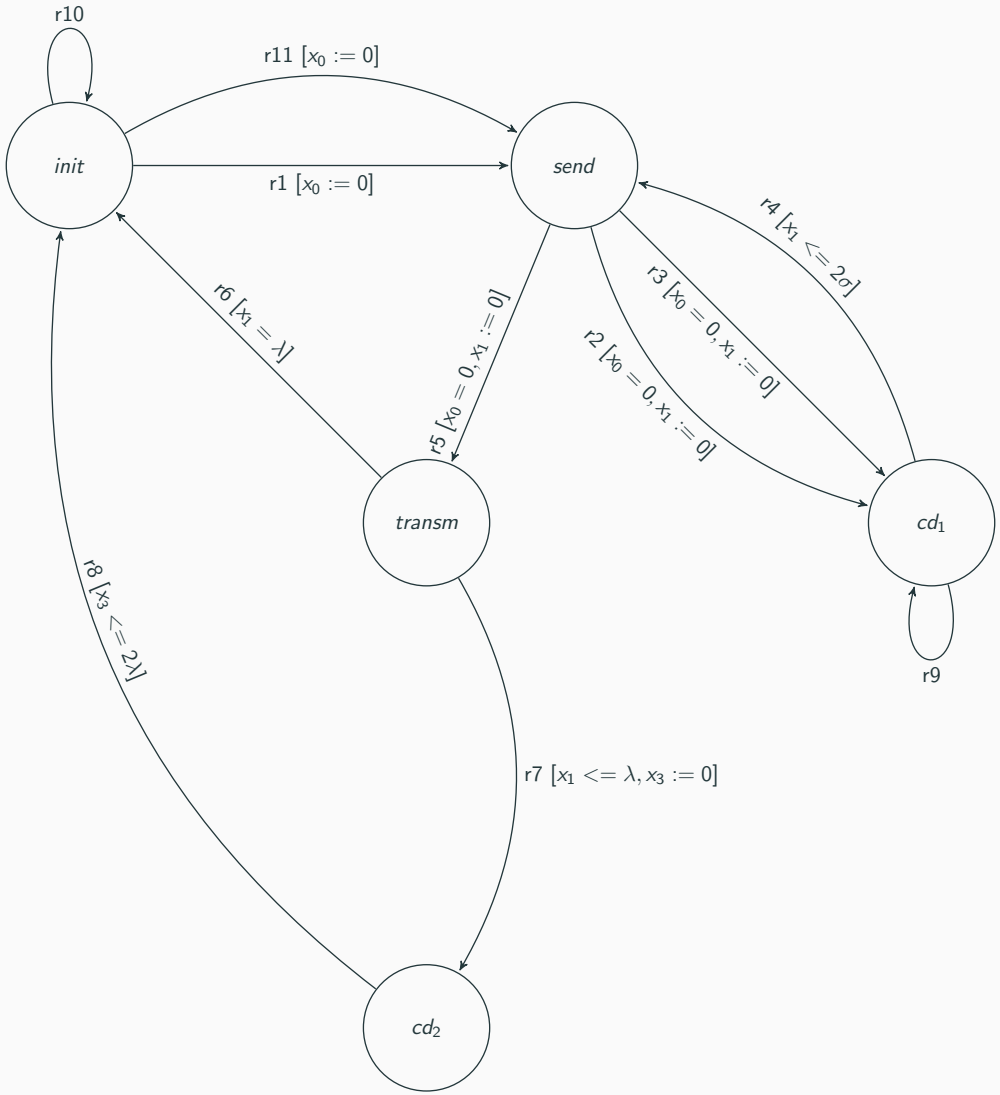


Figure 17: The timed automaton for the sender in CSMA/CD protocol

CSMA/CD Protocol

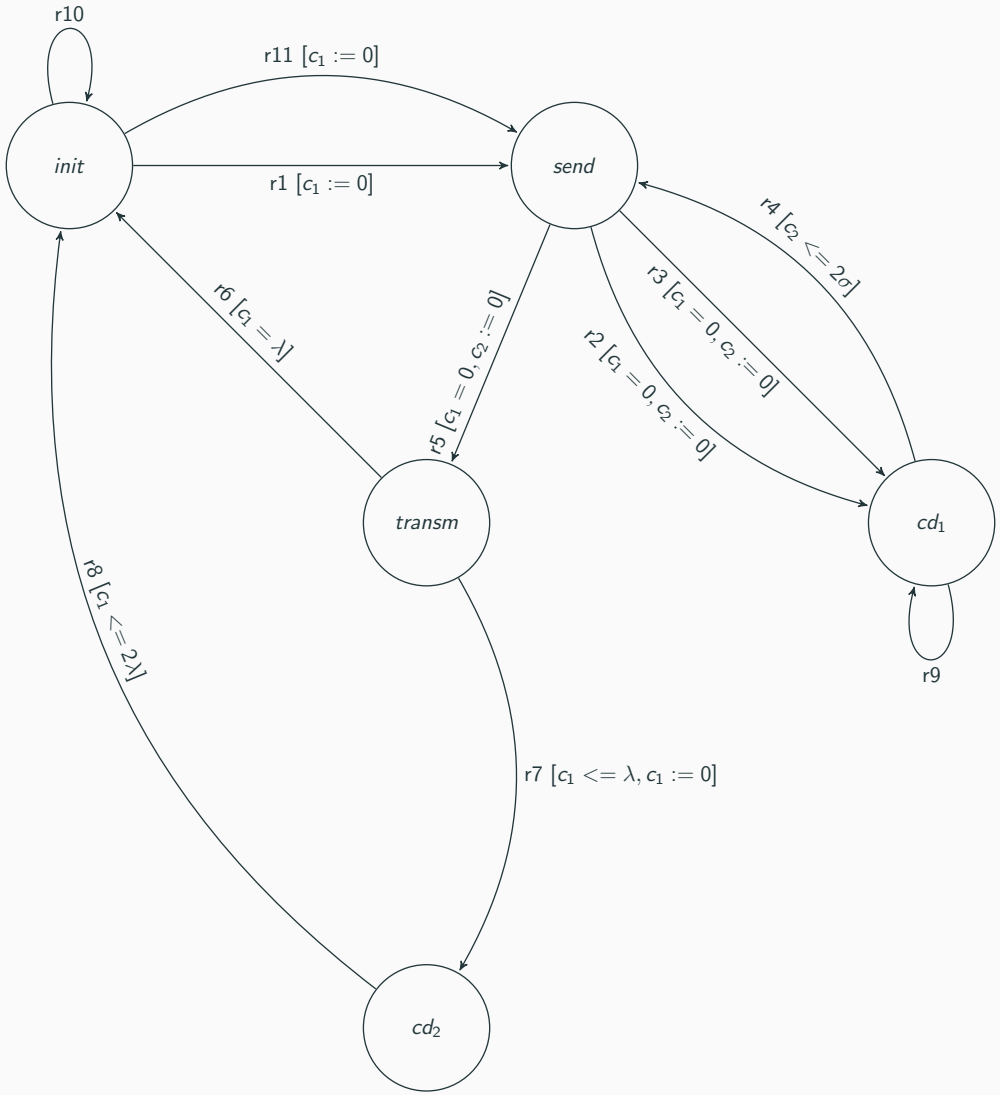


Figure 18: The optimally allocated timed automaton for the sender in CSMA/CD protocol

Conclusion

Conclusion

conclude here [2] [3]

Questions?

References i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