Properties of P^2TA

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Timed Automata

Definition

A Timed Automaton consists of

- L, finite set of locations
- $l_{init} \in L$, initial location
- $\mathbb{X}$, finite set of clocks
- $E \subseteq L \times Zones(\mathbb{X}) \times 2^{\mathbb{X}} \times$ L , edges

Problem

Timed reachability ✔

Probabilistic Timed Automata

Definition

A Probabilistic Timed Automaton consists of

- L, finite set of locations
- $l_{init} \in L$, initial location
- $\mathbb{X}$, finite set of clocks
- $pE \subseteq L \times Zones(\mathbb{X}) \times 2^{\mathbb{X}} \times Dist(L)$, probabilistic edges

Problem

Timed probabilistic reachability ✔

Priced Timed Automata

Definition

A Priced Timed Automaton consists of

- L, finite set of locations
- $l_{init} \in L$, initial location
- $\mathbb{X}$, finite set of clocks
- $E \subseteq L \times Zones(\mathbb{X}) \times 2^{\mathbb{X}} \times$ L , edges
- $\dot{\$} : L \rightarrow \mathbb{N}$, price rate for each location

Problem

Timed minimal cost reachability ✔

Priced Probabilistic Timed Automata

Definition

A Priced Probabilistic Timed Automaton consists of

- L, finite set of locations
- $l_{init} \in L$, initial location
- $\mathbb{X}$, finite set of clocks
- $pE \subseteq L \times Zones(\mathbb{X}) \times 2^{\mathbb{X}} \times Dist(L)$, probabilistic edges
- $\dot{\$} : L \rightarrow \mathbb{N}$, price rate for each location

Problem

Timed cost-bounded probabilistic reachability ✔ 2

Photocopier Maintenance

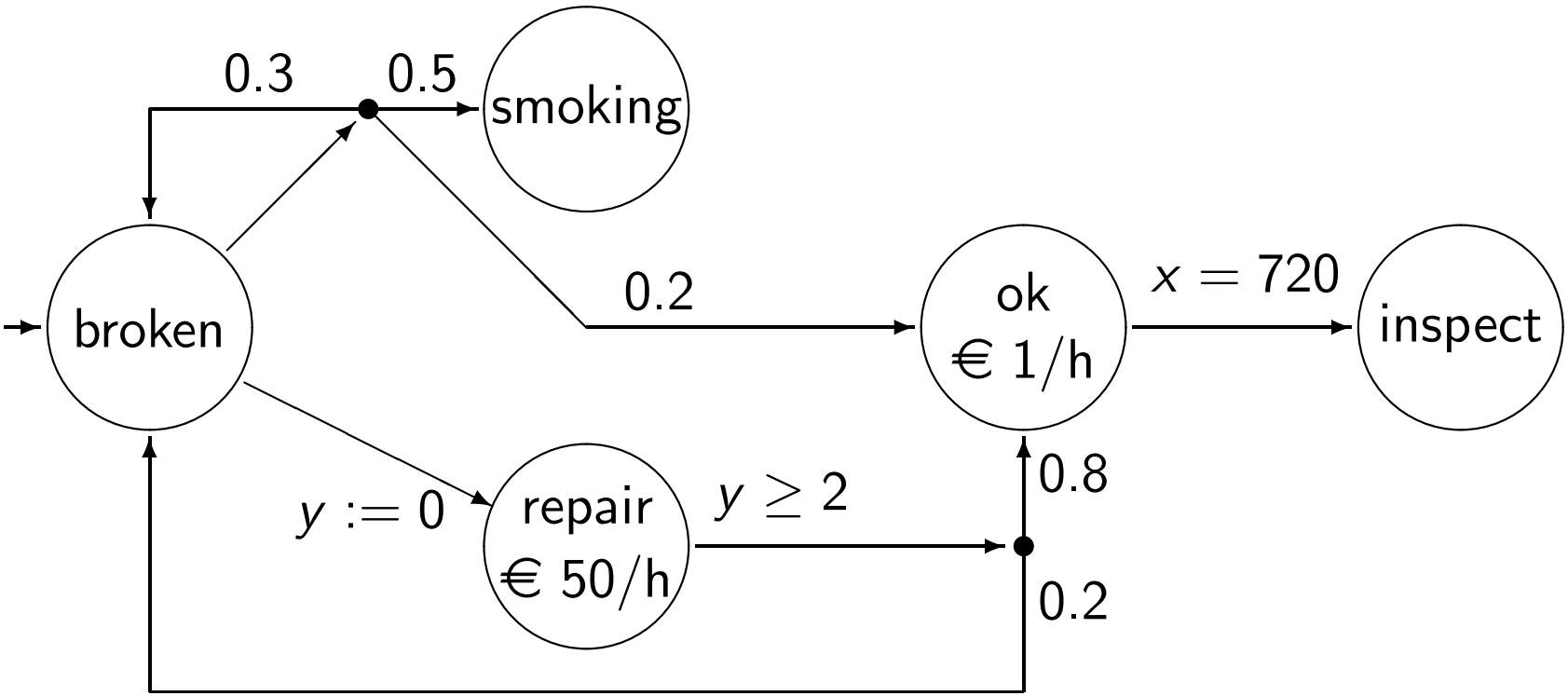
Example

The support department maintains a photocopier.
If it's working, it costs € 1 per hour.
If it's broken, the support clerk can:

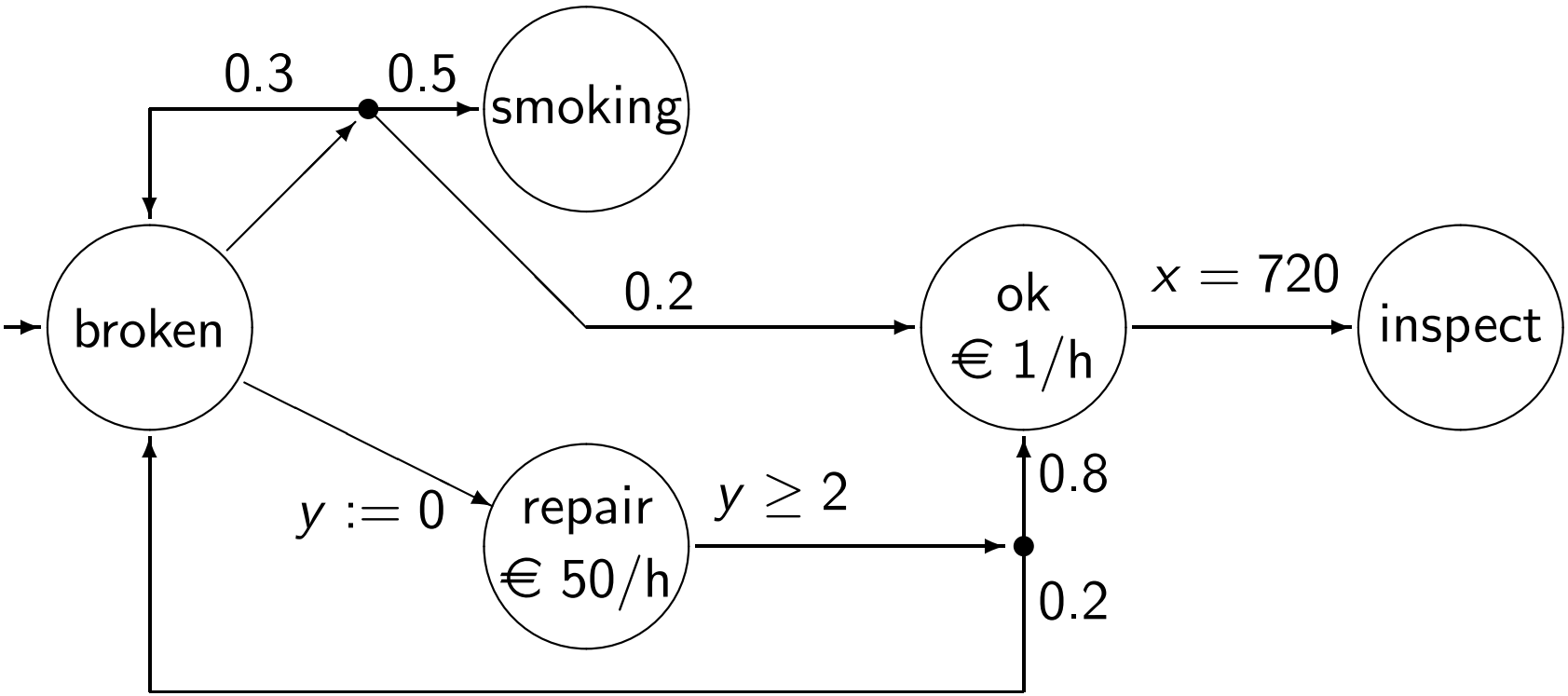
- kick the photocopier (free)
  $Prob(\text{success}) = 0.2$, $Prob(\text{final failure}) = 0.5$
- call a mechanic (€ 50 per hour)
  $Prob(\text{success}) = 0.8$

The department has to ensure that
$Prob(\text{photocopier costs} \leq € 500 \text{ at monthly inspection}) > 0.9$.

Photocopier Maintenance Model



Photocopier Maintenance Model



Problem

Is there a scheduler that ensures:
Prob(Reach inspect *with cost* ≤ 500*)* > 0.9*?*

Further Problems

Problem

The maximal expected cost to reach a given location (over all schedulers)

Problem

The minimal expected cost per time unit (over all schedulers)