**Technische Universität München (I7)** **Winter Semester 2021-22**
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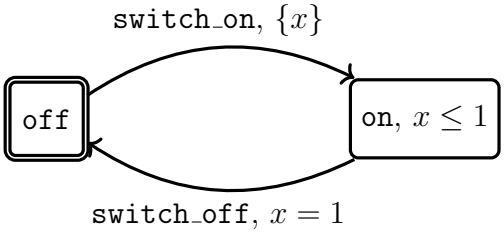
# Quantitative Verification – Exercise sheet 4

**Exercise 4.1**

Consider the timed automaton shown in figure 1. Model check the TCTL properties "$\mathbf{E}\Diamond^{\leq 1}\texttt{on}$" and "$\mathbf{A}\Diamond^{\leq 1}\texttt{on}$". To this end, draw the region transition system, augmented with a new clock $z$.




**Exercise 4.2**

Model Fischer's mutual exclusion protocol (shown in algorithm 1) in UPPAAL. For a system of 10 processes following this protocol, verify the listed properties.

1. Mutual exclusion.
2. Deadlock free.
3. Whenever $P_3$ request access to the critical section it will eventually enter the wait state.

**Algorithm 1:** Fischer's mutual exclusion protocol

```
Input: id: Global, atomic variable, initialized to 0. delay: waiting time parameter
while true do
    while id ≠ −1 do
        continue
    end
    id ← i
    pause(delay)
    if id = i then
        // critical section
        id ← −1
    end
end
```