Exercise 1

Consider the following timed automaton $\mathcal{T}$:

Please perform the TCTL model checking algorithm as presented in the lecture on $\mathcal{T}$ and verify $\mathcal{T} \models \varphi$, where $\varphi = AF^{\leq 2}p$.

a) Construct $\hat{\varphi}$ by eliminating timing parameters from $\varphi$. Use the name $y$ for the auxiliary clock.

b) Construct a RTS $\mathcal{R}$, such that $\mathcal{T} \models_{TCTL} \varphi$ iff $\mathcal{R} \models_{CTL} \hat{\varphi}$. As $\mathcal{R}$ will become big, use the prepared grid below to sketch the RTS (by adding the required transitions) as follows:

- $\bigcirc$ represents a state, where the location is $l_0$.
- $\square$ represents a state, where the location is $l_1$.
- The position of a state in the grid remarks, which clock region the state represents.
- Please draw only the reachable fragment of $\mathcal{R}$. 
c) Apply CTL model checking to verify $\mathcal{R} \models_{CTL} \hat{\varphi}$. You can color states in your previously created $RTS$ to indicate that a certain subformula holds in the respective state.