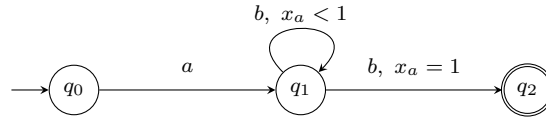
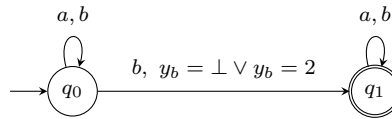


1. Complement the following event-clock automaton:

(4 marks)



2. Consider the following event-clock automaton:



(a) Give an equivalent deterministic event-clock automaton.

(b) Convert the above ECA into an equivalent timed automaton.

(8 marks)

3. Let Σ and Γ be two finite alphabets. A *homomorphism* is a function $h : \Sigma \mapsto \Gamma$. This can be extended to timed words as follows:

$$h((a_1 a_2 \dots a_k, t_1 t_2 \dots t_k)) = (h(a_1) h(a_2) \dots h(a_k), t_1 t_2 \dots t_k)$$

Similarly, for a timed language L , we define $h(L) := \{ h((w, t)) \mid (w, t) \in L \}$.

Call a timed language L to be an *event-clock language* if there is an ECA accepting L .

Given timed language L over Σ , and homomorphism $h : \Sigma \mapsto \Gamma$.

(a) Are event-clock languages closed under homomorphisms? That is, if L is an event-clock language, is $h(L)$ also an event-clock language?

(b) If $h(L)$ is an event-clock language, is L an event-clock language?

(8 marks)