Software Validation and Verification
Third Exercise Sheet

Exercise 1

Let E_{safe} be a safety property. Prove or disprove the following statements:

1. If L is a regular language with $MinBadPref(E_{safe}) \subseteq L \subseteq BadPref(E_{safe})$, then E_{safe} is regular;
2. If E_{safe} is regular, then any L for which $MinBadPref(E_{safe}) \subseteq L \subseteq BadPref(E_{safe})$ is regular.

Exercise 2

Recall that an infinite word $\sigma \in \Sigma^\omega$ is ultimatively periodic if a pair of finite words $x, y \in \Sigma^*$ exist such that $\sigma = xy^\omega$. Prove or disprove the following statement:

Every word recognized by a Büchi automaton is ultimately periodic.

Exercise 3

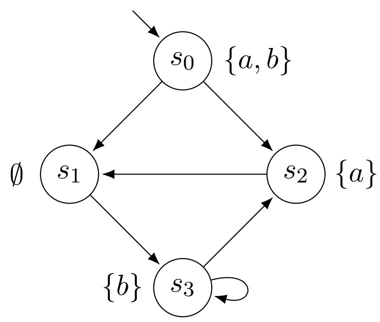
1. Provide NBAs A_1 and A_2 for the languages given by the expressions $(AC + B)^* B^\omega$ and $(B^* AC)^\omega$;
2. Give both a GNBA G and an NBA A with $\mathcal{L}(A) = \mathcal{L}(G) = \mathcal{L}(A_1) \cap \mathcal{L}(A_2)$.
3. Is $\mathcal{L}(G)$ empty?

Exercise 4

Let the ω-regular LT properties E_1 and E_2 over the set of atomic propositions $AP = \{a, b\}$ be (informally) defined by:

- E_1 := "if a holds infinitely often, then b holds finitely often"
- E_2 := "a holds infinitely often and b holds infinitely often"

Consider the following transition system $\mathcal{T}$:



Algorithmically investigate via ω-regular model checking whether $\mathcal{T} \models E_1$ and $\mathcal{T} \models E_2$.