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Exercise Sheet 3

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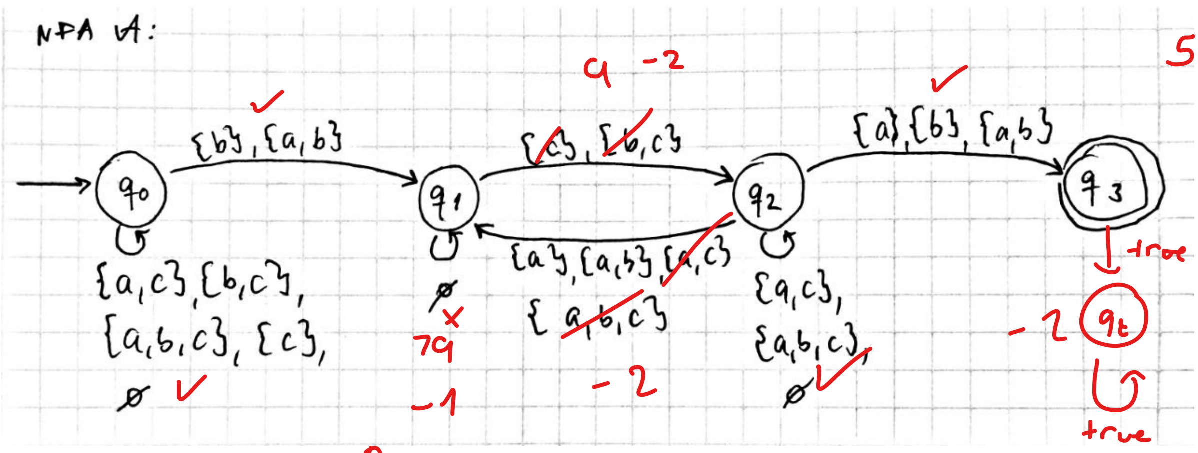
Exercise 1 (Regular Safety Property): 5 / 24

a) 

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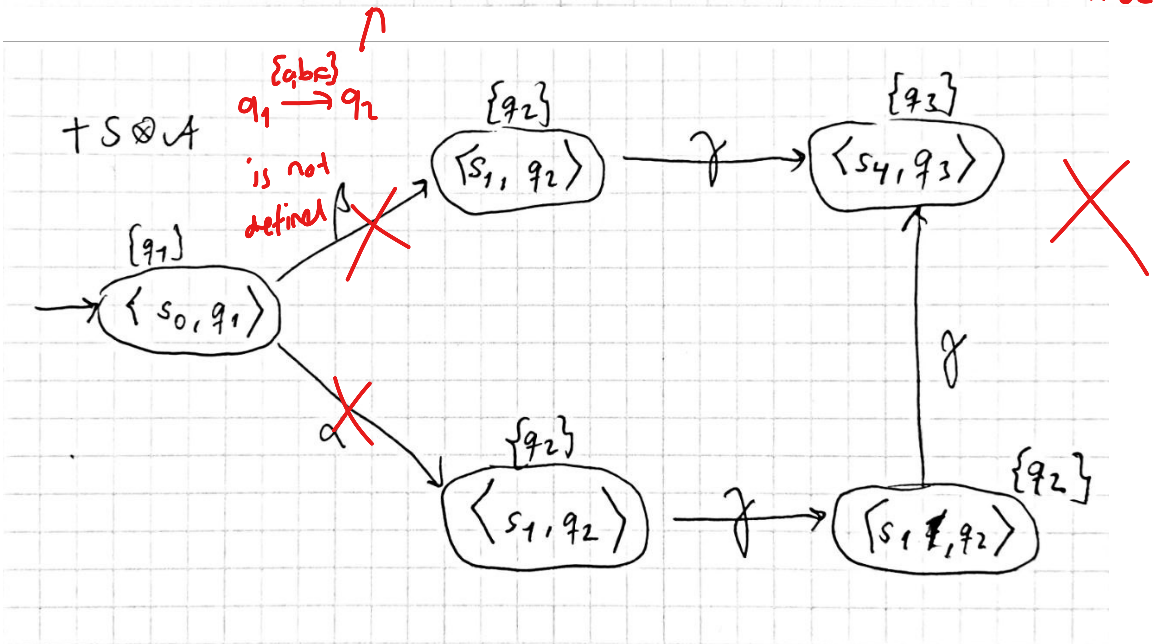
b) 

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Exercise 2 (Closure of LT Properties): 10 / 32

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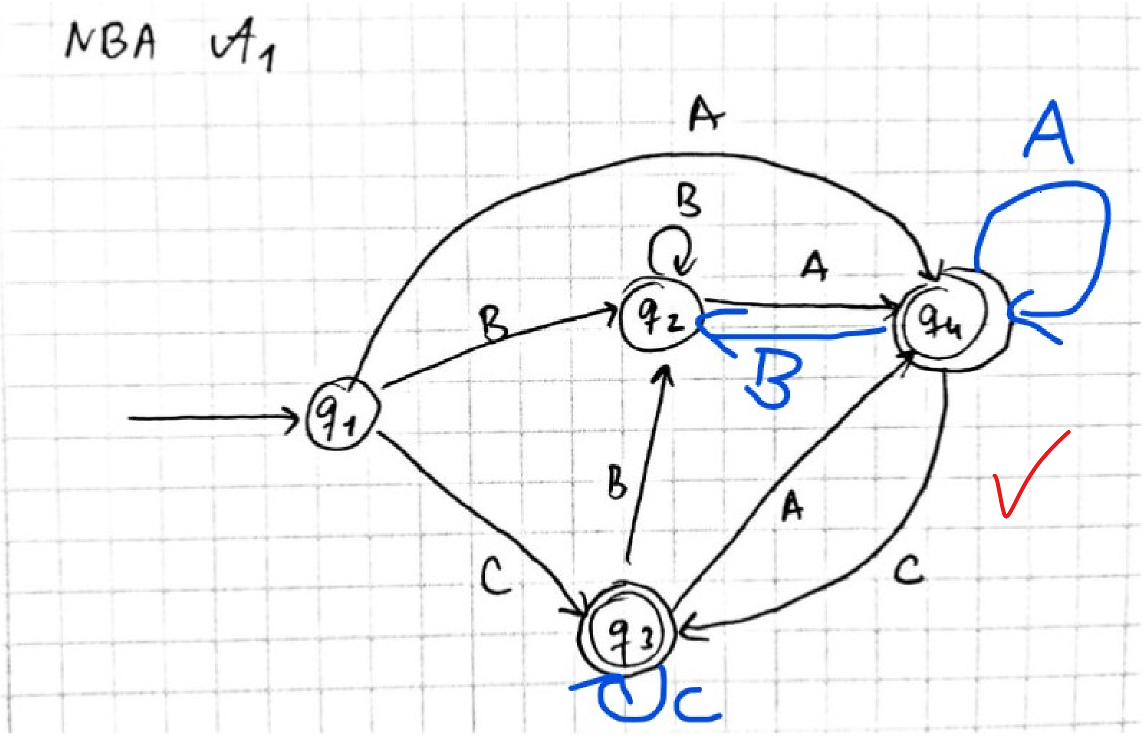

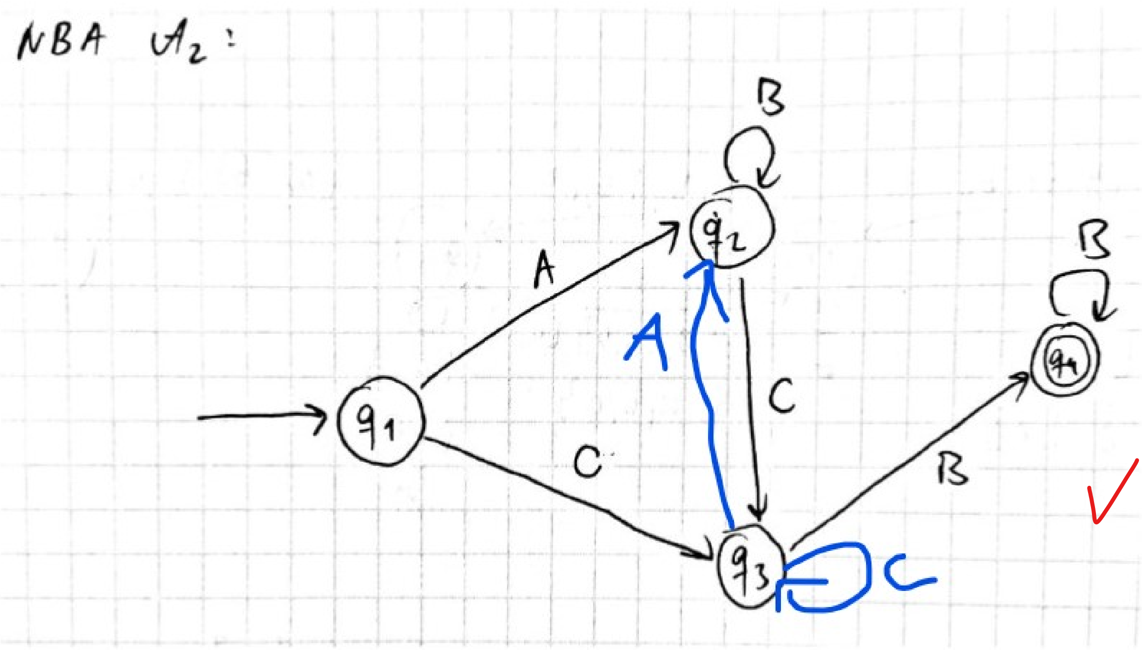

a)

c)

d)

Aufgabe 3 (Finite Trace Equivalence and Safety Properties) 4 / 24

Consider the property: $P_{UP} := \{\{a,b\}^*(ab^k)^\omega | k \in \mathbb{N}\}$. Obviously $Pref_{\cancel{fin}}(P_{UP}) \supseteq \{a,b\}^*$ and thus is a safety property. However it is not a ω-regular property. $\{b\} \notin Pref(P_{UP}) \Rightarrow Pref(UP) \neq (2^{AP})^* \Rightarrow$ not liveness property

Beweis. Assume there exists a Büchi automaton A that recognizes P_{UP}. Let $n \in \mathbb{N}$ such that $n-1$ is the number of states of this automaton. Further let $w := (ab^n)^\omega \in P_{UP}$. We know that A accepts w.

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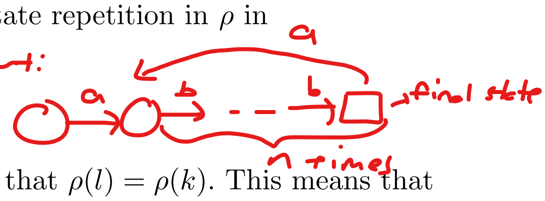
Let ρ be an accepting run of w on A. We know that there is a state repetition in ρ in

Suppose NBA:

$$a\overbrace{b...b}^{\text{this}}(ab^n)^\omega$$

w-part:



part of the word. In other words we can find $2 \leq l < k \leq n$ such that $\rho(l) = \rho(k)$. This means that

You skip here and proceed into the w-part

$$\rho'(x) = \begin{cases} \rho(x) & \text{, iff. } x \leq l \\ \rho(x - l + k) & \text{, iff. } l < x \leq 2n + 2 - k + l \\ \rho'(x \mod (2n - k + l + 2)) & \text{, otherwise} \end{cases}$$

↑ maybe can't repeat earlier than n b's.

is an accepting run for the word: $\left(ab^{n-k+l}ab^n\right)^\omega \notin P_{UP}$ which is a contradiction. □

you need to show why is it an accepting run.

Aufgabe 4 (Safety and Liveness Prperties) 2/20

a) Let $L_1 := (bb|c(aa)^*c)^*$ then A recognizes the language:

$$L_1.b^\omega + L_1.a^\omega$$

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b)

it ends with c^ω or a^ω.

however after words in L_1 the NFA will be in state q_0 so a is not accepted directly after L_1. $L_1.c.a^\omega$ is the right expression.