

Exercise 5F-2. VCGen Do-While [8 points].

Choosing the first option:

$$\text{VC}(c, \text{Inv}) \wedge (\forall x_1, \dots, x_n. \text{Inv} \implies (b \implies \text{VC}(c, \text{Inv}) \wedge \neg b \implies P))$$

Exercise 5F-3. VCGen Mistakes [20 points].

First rule:

1. Targaryen
2. $A = \{x = 1\}$
3. $B = \{x = -1\}$
4. $\sigma = \{x = 1\}$
5. $\sigma' = \{x = -1\}$
6. $c = \text{while } x > 0 \text{ do (if } x > 0 \text{ then } x = -1 \text{ else } x = -2) \text{ end}$
7. $x > 0$ in the loop, so $x = -1$ after the loop ends, resulting in the state σ'
8. $x = 1$ in the initial state σ , so $\sigma \models A$
9. $x = -1$ after the loop ends, so $\sigma' \models B$
10. Since the targaryen rule does not give us information on whether b is true during the evaluation of c , we cannot determine which branch is taken in the if-statement. After the loop, we do not know if $x = -2$ or $x = -1$ without information on b , so it is not possible to prove $\vdash \{A\} c \{B\}$.

Second rule:

1. Stark
2. $A = \{x = 1\}$
3. $B = \{x = 0\}$
4. $\sigma = \{x = 1\}$
5. $\sigma' = \{x = 0\}$
6. $c = \text{while } x > 0 \text{ do } x = x - 1 \text{ end}$
7. $x > 0$ initially, and after one iteration, we get $x = 0$, which results in the state σ'

Question assigned to the following page: [3](#)

8. $x = 1$ in the initial state σ , so $\sigma \models A$
9. $x = 0$ after the loop ends, so $\sigma' \models B$
10. The invariant X of the loop is $(x > 0 \wedge x = 1) \vee (x \leq 0 \wedge x = 0)$. Since the stark rule does not give us information on whether b is false after the loop, we cannot determine if $x \leq 0$ and subsequently $x = 0$. Since we do not know which disjunct is true, it is not possible to prove $\vdash \{A\} c \{B\}$.