Exercise 5F-2.

$VC(\text{do}_{Inv1,Inv2}\ c \text{ while } b, P) = Inv1 \wedge (\forall x_1 \ldots x_n.Inv1 \implies ((b \implies VC(c, Inv2)) \wedge (\neg b \implies P))) \wedge (\forall x_1 \ldots x_n.Inv2 \implies ((b \implies VC(c, Inv2)) \wedge (\neg b \implies P)))$

Where $x_1 \ldots x_n$ are all variables modified in c.

Exercise 5F-3.

Rule 1

1. stark
2. A := (x = 0)
3. B := (x = 1)
4. σ := {x = 0}
5. σ' := {x = 1}
6. c := while x < 1 do x := x + 1
7. $\langle$ while x < 1 do x := x + 1, {x = 0} $\rangle \Downarrow$ {x = 1}
8. {x = 0} $\models$ (x = 0)
9. {x = 1} $\models$ (x = 1)
10. Since stark has the same conditions on each side of the conclusion about while, and since it's not true that x = 1 before c, we cannot prove that x = 1 after c.

Rule 2

1. targaryen
2. A := (x = 0)
3. B := (x = 1)
4. σ := {x = 0}
5. σ' := {x = 1}
6. c := while x < 1 do x := x + 1

Question assigned to the following page: 3

Peer Review ID: 320296950 — enter this when you fill out your peer evaluation via gradescope

7. $\langle$ while x $<$ 1 do x := x + 1, {x = 0} $\rangle \Downarrow$ {x = 1}
8. {x = 0} $\models$ (x = 0)
9. {x = 1} $\models$ (x = 1)
10. To prove {x = 0} while x $<$ 1 do x := x + 1 {x = 1} using targaryen, we would need to find some predicate X such that {X} x := x + 1 {X} and (X $\land \neg$ x = 0) $\implies$ x = 1. From the Hoare rule for assignment, we get [x + 1/x]X = X, meaning X does not refer to x, so (X $\land \neg$ x = 0) cannot prove x = 1.

Peer Review ID: 320296950 — enter this when you fill out your peer evaluation via gradescope