

14F-1 Bookkeeping

- 0 pts Correct

Exercise 4F-2. VCGen for Let [6 points].

Suppose we pick a fresh, no-conflicting new variable x_0 . Then $(\text{let } x = e \text{ in } c)$ is equivalent to $(x_0 = x; x = e; c; x = x_0)$.

Thus:

$$\begin{aligned} \text{VC}(\text{let } x = e \text{ in } c, B) &= \text{VC}(x_0 = x; x = e; c; x = x_0, B) \\ &= [x/x_0][e/x]\text{VC}(c, [x_0/x]B) \end{aligned}$$

Exercise 4F-3. VCGen Mistakes [6 points].

1. Command c : $\text{let } x = y \text{ in skip}$
2. Post-condition B : $\{x > 2\}$
3. Initial state σ : $\{x = 1 \wedge y = 3\}$
4. Given the buggy let rule: $\text{VC}(c, B) = [y/x]\{x > 2\} = \{y > 2\}$. Since in σ we have $y = 3 > 2$, thus $\sigma \models \text{VC}(c, B)$
5. Given the definition of let statement we have $\langle c, \sigma \rangle \Downarrow \sigma'$ where $\sigma' = \{x = 1 \wedge y = 3\}$
6. However $\sigma' \not\models B$ since $x = 1 \not> 2$

Exercise 4F-4. Axiomatic Do-While [6 points].

We can transform $(\text{do } c \text{ while } b)$ into $(c; \text{while } b \text{ do } c)$

Thus the rule is

$$\frac{\vdash \{A\} c \{B\} \quad \{B \wedge b\} c \{B\}}{\vdash \{A\} \text{do } c \text{ while } b \{B \wedge \neg b\}}$$

2 4F-2 VCGen for Let

- 0 pts Correct

Exercise 4F-2. VCGen for Let [6 points].

Suppose we pick a fresh, no-conflicting new variable x_0 . Then $(\text{let } x = e \text{ in } c)$ is equivalent to $(x_0 = x; x = e; c; x = x_0)$.

Thus:

$$\begin{aligned} \text{VC}(\text{let } x = e \text{ in } c, B) &= \text{VC}(x_0 = x; x = e; c; x = x_0, B) \\ &= [x/x_0][e/x]\text{VC}(c, [x_0/x]B) \end{aligned}$$

Exercise 4F-3. VCGen Mistakes [6 points].

1. Command c : $\text{let } x = y \text{ in skip}$
2. Post-condition B : $\{x > 2\}$
3. Initial state σ : $\{x = 1 \wedge y = 3\}$
4. Given the buggy let rule: $\text{VC}(c, B) = [y/x]\{x > 2\} = \{y > 2\}$. Since in σ we have $y = 3 > 2$, thus $\sigma \models \text{VC}(c, B)$
5. Given the definition of let statement we have $\langle c, \sigma \rangle \Downarrow \sigma'$ where $\sigma' = \{x = 1 \wedge y = 3\}$
6. However $\sigma' \not\models B$ since $x = 1 \not> 2$

Exercise 4F-4. Axiomatic Do-While [6 points].

We can transform $(\text{do } c \text{ while } b)$ into $(c; \text{while } b \text{ do } c)$

Thus the rule is

$$\frac{\vdash \{A\} c \{B\} \quad \{B \wedge b\} c \{B\}}{\vdash \{A\} \text{do } c \text{ while } b \{B \wedge \neg b\}}$$

3 4F-3 VCGen Mistakes

- 0 pts Correct

Exercise 4F-2. VCGen for Let [6 points].

Suppose we pick a fresh, no-conflicting new variable x_0 . Then $(\text{let } x = e \text{ in } c)$ is equivalent to $(x_0 = x; x = e; c; x = x_0)$.

Thus:

$$\begin{aligned} \text{VC}(\text{let } x = e \text{ in } c, B) &= \text{VC}(x_0 = x; x = e; c; x = x_0, B) \\ &= [x/x_0][e/x]\text{VC}(c, [x_0/x]B) \end{aligned}$$

Exercise 4F-3. VCGen Mistakes [6 points].

1. Command c : $\text{let } x = y \text{ in skip}$
2. Post-condition B : $\{x > 2\}$
3. Initial state σ : $\{x = 1 \wedge y = 3\}$
4. Given the buggy let rule: $\text{VC}(c, B) = [y/x]\{x > 2\} = \{y > 2\}$. Since in σ we have $y = 3 > 2$, thus $\sigma \models \text{VC}(c, B)$
5. Given the definition of let statement we have $\langle c, \sigma \rangle \Downarrow \sigma'$ where $\sigma' = \{x = 1 \wedge y = 3\}$
6. However $\sigma' \not\models B$ since $x = 1 \not> 2$

Exercise 4F-4. Axiomatic Do-While [6 points].

We can transform $(\text{do } c \text{ while } b)$ into $(c; \text{while } b \text{ do } c)$

Thus the rule is

$$\frac{\vdash \{A\} c \{B\} \quad \{B \wedge b\} c \{B\}}{\vdash \{A\} \text{do } c \text{ while } b \{B \wedge \neg b\}}$$

4 4F-4 Axiomatic Do-While

- 0 pts Correct