

$$\begin{aligned} \text{vc}(\{n \geq 0\} \ x := 1 \ \{x = 1 \wedge n \geq 0\}) &= \{n \geq 0 \Rightarrow [1/x](x = 1 \wedge n \geq 0)\} \\ &= \{n \geq 0 \Rightarrow (1 = 1 \wedge 1 \geq 0)\} \text{ OP1} \end{aligned}$$

$$\begin{aligned} \text{vc}(\{x = 1 \wedge n \geq 0\} \ y := n \ \{x \times y' = n' \wedge y \geq 0\}) \\ &= \{(x = 1 \wedge n \geq 0) \Rightarrow [n/y](x \times y' = n' \wedge y \geq 0)\} \\ &= \{(x = 1 \wedge n \geq 0) \Rightarrow (x \times n' = n' \wedge n \geq 0)\} \text{ CQFD} \end{aligned}$$

$$\begin{aligned} \text{vc}(\{x \times y' = n' \wedge y \geq 0\} \text{ while } y \neq 0 \text{ inv } x \times y' = n' \wedge y \geq 0 \text{ var } y \text{ do} \\ \quad \text{P odd } \{x = n'\} \}) \end{aligned}$$

$$\begin{aligned} &= \{(x \times y' = n' \wedge y \geq 0 \wedge \neg(y \neq 0)) \Rightarrow \{x = n'\}, \text{ OP3} \\ &\quad (x \times y' = n' \wedge y \geq 0) \Rightarrow (x \times y' = n' \wedge y \geq 0)\} \text{ CQFD} \\ \text{Uvc}(\{x \times y' = n' \wedge y \geq 0 \wedge y \neq 0\} \text{ P } \{x \times y' = n' \wedge y \geq 0\}) \end{aligned}$$

$$\begin{aligned} \text{vc}(\{x \times y' = n' \wedge y \geq 0 \wedge y \neq 0\} \ x := x \times y \ \{x \times (y-1)' = n' \wedge (y-1) \geq 0\}) \\ &= (x \times y' = n' \wedge y \geq 0 \wedge y \neq 0) \Rightarrow [x \times y/x](x \times (y-1)' = n' \wedge (y-1) \geq 0) \\ &= (x \times y' = n' \wedge y \geq 0 \wedge y \neq 0) \Rightarrow (x \times y \times (y-1)' = n' \wedge (y-1) \geq 0) \text{ OP2} \end{aligned}$$

$$\begin{aligned} \text{vc}(\{x \times (y-1)' = n' \wedge (y-1) \geq 0\} \ y := y-1 \ \{x \times y' = n' \wedge y \geq 0\}) \\ &= (x \times (y-1)' = n' \wedge (y-1) \geq 0) \Rightarrow [y-1/y](x \times y' = n' \wedge y \geq 0) \\ &= (x \times (y-1)' = n' \wedge (y-1) \geq 0) \Rightarrow (x \times (y-1)' = n' \wedge (y-1) \geq 0) \text{ CQFD} \end{aligned}$$