123 Let $x$ be an integer state variable. Is the following specification implementable?

(a) $x \geq 0 \implies x'^2 = x$

(b) $x' \geq 0 \implies x = 0$

(c) $\neg(x \geq 0 \ \wedge \ x' = 0)$

(d) $\neg(x \geq 0 \ \vee \ x' = 0)$

After trying the question, scroll down to the solution.

(a) $x \geq 0 \Rightarrow x'^2 = x$

§ No, not implementable. When $x = 2$, we require an integer $x'$ whose square is $2$. There isn't one.

(b) $x' \geq 0 \Rightarrow x = 0$

§ Yes, implementable. $x' = -1$ is satisfactory for any $x$.

(c) $\neg(x \geq 0 \wedge x' = 0)$

§ Yes, implementable. $x' = 1$ is satisfactory for any $x$.

(d) $\neg(x \geq 0 \vee x' = 0)$

§ No, not implementable. When $x = 0$, there is no satisfactory $x'$.