Let $n$ be a natural variable, and let $b$ be a binary variable. Write a program to determine whether $3$ is a factor of $n$ (whether $3$ divides evenly into $n$ with no remainder), reporting the answer as the final value of $b$. Your program can use addition, subtraction, comparison, and binary operators, but not multiplication, division, $\text{div}$, $\text{mod}$, $\text{floor}$, or $\text{ceil}$. (Your non-program specifications can use anything.)

(a) Write a formal specification.
(b) Refine your specification to obtain a program. You do not need to prove the refinements.

After trying the question, scroll down to the solution.
(a) Write a formal specification.
\[ b' \equiv (\text{mod } n = 0) \]

(b) Refine your specification to obtain a program. You do not need to prove the refinements.
\[ b' \equiv (\text{mod } n = 0) \iff \begin{cases} 
\text{if } n < 3 & \text{then } b := (n = 0) \\
\text{else } n := n - 3. & b' \equiv (\text{mod } n = 0) \end{cases} \]