Let $x$ and $y$ be rational variables. Define program $zot$ by the fixed-point equation
\begin{align*}
zot &= \text{if } x=y \text{ then } y := 0 \text{ else } x := (x+y)/2. \quad zot \text{ fi}
\end{align*}

(a) Add recursive time.
\begin{align*}
zot &= \text{if } x=y \text{ then } y := 0 \text{ else } x := (x+y)/2. \quad t := t+1. \quad zot \text{ fi}
\end{align*}

(b) Give two solutions to this equation (with recursive time added) (considering $zot$ as the unknown). (No proof needed.)
\begin{align*}
\text{Here are three solutions. The first is the result of recursive construction if we start with } T. \\
x = y \Rightarrow (y := 0)
\end{align*}

The next is the result of recursive construction if we start with $t' \geq t$.
\begin{align*}
\text{if } x=y \text{ then } y := 0 \text{ else } t' := \infty \text{ fi}
\end{align*}

If execution starts with $x+y$, it's an infinite loop, so we can say anything about the final values $x'$ and $y'$, since they are unobservable. The next solution is
\begin{align*}
\text{if } x=y \text{ then } y := 0 \text{ else } x' = 12 \land y' = 17 \land t' = \infty \text{ fi}
\end{align*}

(c) The definition of $zot$ makes it a solution (fixed-point) of an equation. What axiom is needed to make $zot$ the weakest solution (weakest fixed-point)?
\begin{align*}
(\forall x, y, t, x', y', t'). \quad Z &= \text{if } x=0 \text{ then } y := 0 \text{ else } x := (x+y)/2. \quad t := t+1. \quad Z \text{ fi} \\
\Rightarrow (\forall x, y, t, x', y', t'). \quad Z \Rightarrow zot
\end{align*}