Let $i$ be an integer variable, and let $P$ be a specification such that

\[ P = \text{if } i=0 \text{ then } i := 3 \text{ else } P \text{ fi } \]

(a) Add recursive time.

\[ P = \text{if } i=0 \text{ then } i := 3 \text{ else } t := t+1. \ P \text{ fi } \]

(b) Using recursive construction, find the weakest fixed-point (weakest solution for $P$), including time. You do not need to prove that recursive construction results in the weakest solution.

\[ P_0 = \top \]
\[ P_1 = \text{if } i=0 \text{ then } i := 3 \text{ else } t := t+1. \ \top \text{ fi } \]
\[ = \text{if } i=0 \text{ then } i' = 3 \land t' = t \text{ else } \top \text{ fi } \]
\[ = i=0 \Rightarrow i' = 3 \land t' = t \]
\[ P_2 = \text{if } i=0 \text{ then } i := 3 \text{ else } t := t+1. \ i=0 \Rightarrow i' = 3 \land t' = t \text{ fi } \]
\[ = \text{if } i=0 \text{ then } i' = 3 \land t' = t \text{ else } i=0 \Rightarrow i' = 3 \land t' = t+1 \text{ fi } \]
\[ = \text{context} \]
\[ = \text{if } i=0 \text{ then } i' = 3 \land t' = t \text{ else } \top \text{ fi } \]
\[ = i=0 \Rightarrow i' = 3 \land t' = t \]
\[ = P_1 \]

The weakest fixed-point (solution) $i=0 \Rightarrow i' = 3 \land t' = t$ has been found.