139 In natural variables n and m prove

$$P \Leftarrow n{:=}\, n{+}1.\ \textbf{if}\ n{=}10\ \textbf{then}\ ok\ \textbf{else}\ m{:=}\, m{-}1.\ P\ \textbf{fi}$$

where $P = m{:=}\, m{+}n{-}9.\ n{:=}\, 10$.

After trying the question, scroll down to the solution.

§ $n := n+1.\ \textbf{if}\ n=10\ \textbf{then}\ ok\ \textbf{else}\ m := m-1.\ P\ \textbf{fi}$ replace ok and P

$= \quad n := n+1.\ \textbf{if}\ n=10\ \textbf{then}\ m'=m \wedge n'=n\ \textbf{else}\ m := m-1.\ m := m+n-9.\ n := 10\ \textbf{fi}$ replace final assignment

$= \quad n := n+1.\ \textbf{if}\ n=10\ \textbf{then}\ m'=m \wedge n'=n\ \textbf{else}\ m := m-1.\ m := m+n-9.\ m'=m \wedge n'=10\ \textbf{fi}$ two substitutions

$= \quad n := n+1.\ \textbf{if}\ n=10\ \textbf{then}\ m'=m \wedge n'=n\ \textbf{else}\ m'=m-1+n-9 \wedge n'=10\ \textbf{fi}$ substitution

$= \quad \textbf{if}\ n+1=10\ \textbf{then}\ m'=m \wedge n'=n+1\ \textbf{else}\ m'=m-1+n+1-9 \wedge n'=10\ \textbf{fi}$ arithmetic

$= \quad \textbf{if}\ n=9\ \textbf{then}\ m'=m \wedge n'=n+1\ \textbf{else}\ m'=m+n-9 \wedge n'=10\ \textbf{fi}$ context

$= \quad \textbf{if}\ n=9\ \textbf{then}\ m'=m+n-9 \wedge n'=10\ \textbf{else}\ m'=m+n-9 \wedge n'=10\ \textbf{fi}$ case idempotent

$= \quad m'=m+n-9 \wedge n'=10$ definitions of assignment and sequential composition

$= \quad m := m+n-9.\ n := 10$

$= \quad P$