508 The equation

$$printTime \;=\; screen!\, t.\;\; t := t+1.\;\; printTime$$

outputs the time t onto the *screen* channel once each time unit forever. Considering *printTime* as the unknown,

(a) what is the weakest solution to this equation? (No proof required.)

(b) what is the strongest solution to this equation? (No proof required.)

After trying the question, scroll down to the solution.

(a) what is the weakest solution to this equation? (No proof required.)

§ Removing the output and assignment notations,

$$printTime \;=\; \mathcal{M}_w{=}\mathcal{T}_w{=}t \wedge w'{=}w{+}1 \wedge r'{=}r \wedge t'{=}t{+}1.\ printTime$$

Now we can use recursive construction starting with $\top$.

$$printTime_n \;=\; \forall i{:}\ 0,..n{\cdot}\ \mathcal{M}_{w+i}{=}\mathcal{T}_{w+i}{=}t{+}i$$

$$printTime_\infty \;=\; \forall i{:}\ nat{\cdot}\ \mathcal{M}_{w+i}{=}\mathcal{T}_{w+i}{=}t{+}i$$

This is the weakest solution (weakest fixed-point).

(b) what is the strongest solution to this equation? (No proof required.)

§ If we start with $\bot$, then

$$printTime_n \;=\; printTime_\infty \;=\; \bot$$

This is the strongest solution (strongest fixed-point).