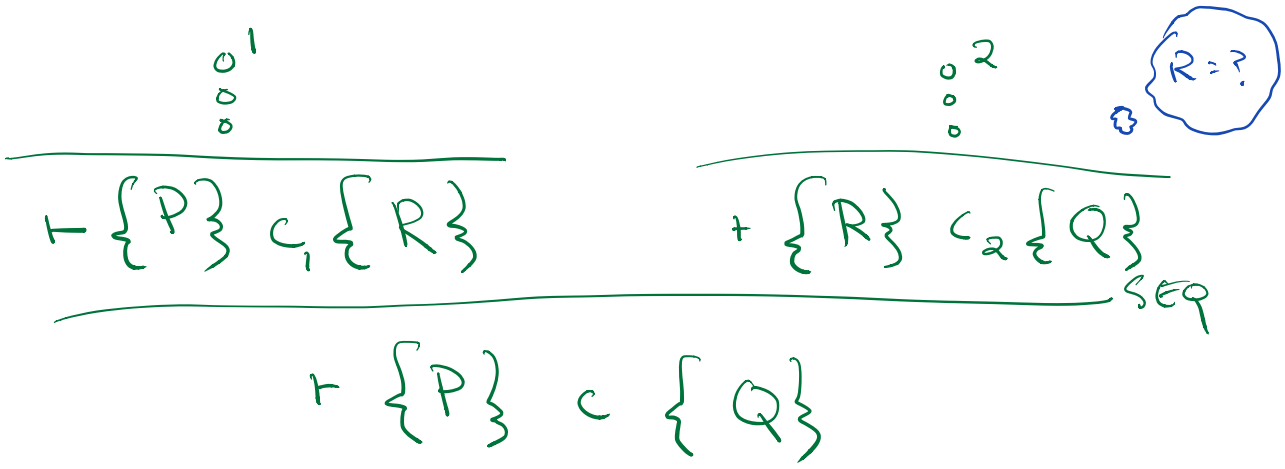
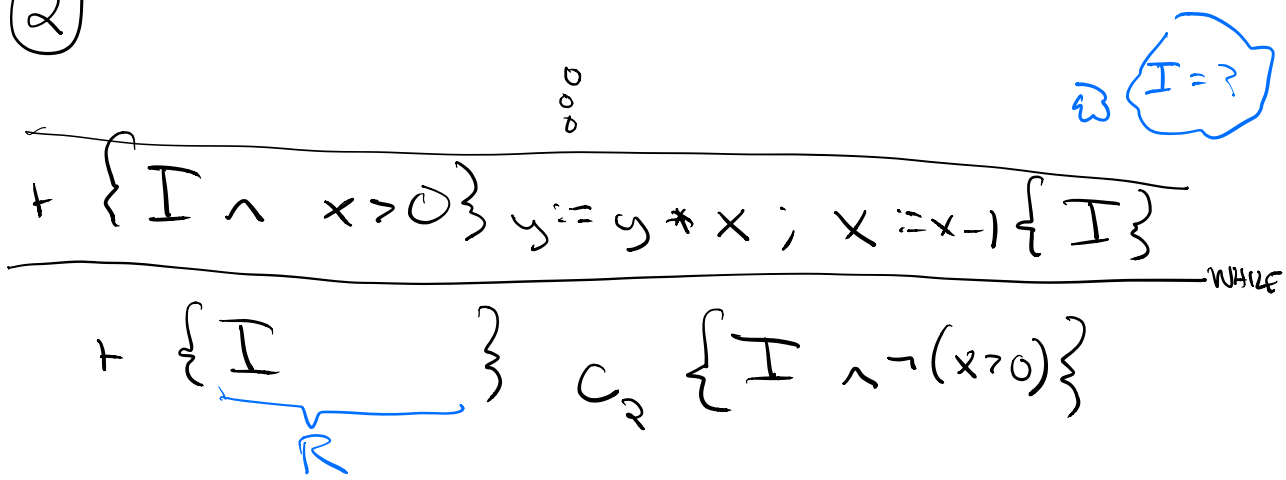
$\{x = n \wedge n > 0\}$ ← P

c_1 { y := 1;
while x > 0 **do**
(y := y * x;
x := x − 1) } C

$\{y = n!\}$ ← Q



(2)



$y = 1 \times n \times (n-1) \times \cdots \times (x+1)$

$y = n!/x! \quad \wedge \quad x \geq 0$

$I \triangleq \quad x!\, y = n! \quad \wedge \quad x \geq 0$

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(1)

$$\frac{}{\vdash \{\quad\}\ y := 1\ \{I\}}\ \text{ASSGN}$$

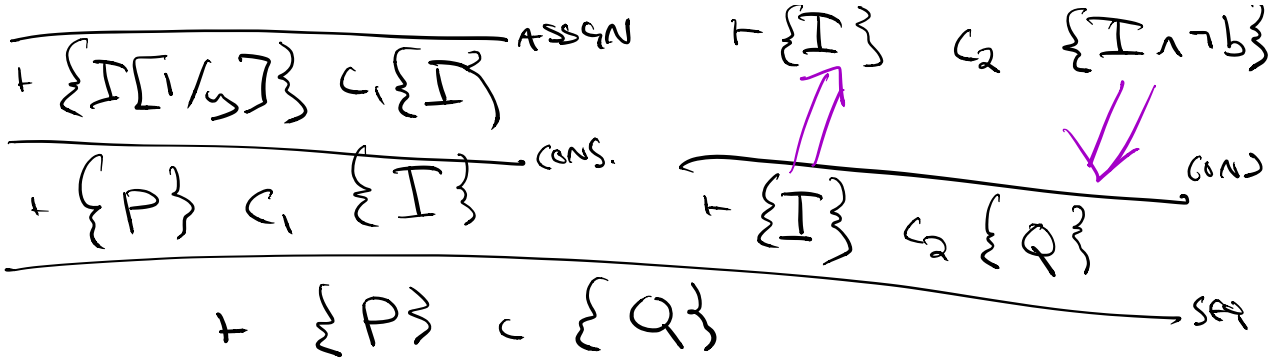
$I[1/y] = x!\,1 = n! \wedge x \geq 0$

$$\frac{P \Rightarrow I[1/y] \qquad \vdash I \Rightarrow I}{\vdash \{P\}\ y := 1\ \{I\}}\ \text{CONSEQ}$$

$x = n \wedge n > 0 \Rightarrow x!\,1 = n! \wedge x \geq 0$

RECAP

$$\frac{\vdots}{\vdash \{I \wedge b\}\ \_\_\_\ \{I\}}\ \text{WHILE}$$



$I \wedge \neg b \Rightarrow Q$

$x! y = n! \wedge x \geq 0 \wedge \neg (x > 0) \Rightarrow$

$y = n!$

$\vdash \{I \wedge b\}\ y := y * x;\ x := x - 1\ \{I\}$

$\{P\}$

$\Rightarrow \{x! * y = n! \wedge x \geq 0\}$ $I = \ldots$

$y := 1$

$\{x! y = n! \wedge x \geq 0\}$

while $x > 0$ do (

$\{I \wedge x > 0\}$

$\Rightarrow \{(x-1)!(y*x) = n! \wedge \cdots\}$

$y := y * x$

$\{(x-1)!\, y = n! \wedge \cdots\}$

$x := x - 1$

$\{x!\, y = n! \wedge \cdots\}$

)

$\{I \wedge \neg(x > 0)\}$

$\Rightarrow \{y = n!\}$