

Exersice Sheet 3

———— Sample Solution ————

Task 1: Operational Equivalence

Prove or disprove:

repeat c **until** $b \sim c$; **while** b **do** c **end**

The claim will be disproved using a counter example.

Lets assume $b := \mathbf{true}$ and $c := \mathbf{skip}$.

The **repeat** statement will terminate after the first iteration with

$\langle \mathbf{repeat} \ c \ \mathbf{until} \ b, \sigma \rangle \rightarrow \sigma$ while the **while** statement will never terminate as its condition is always satisfied.

Task 2: Translation of Statements

$$\mathfrak{T}_c[\mathbf{repeat} \ c \ \mathbf{until} \ b] = \mathfrak{T}_c[c]; \ \mathfrak{T}_b[b]; \ \mathbf{JMPF}(-|\mathfrak{T}_c[c]| + |\mathfrak{T}_b[b]|)$$

Task 3: loop Loops

(a)

$$\frac{\langle x > 0, \sigma \rangle \rightarrow \mathbf{false}}{\langle \mathbf{loop} \ x \ \mathbf{begin} \ c \ \mathbf{end}, \sigma \rangle \rightarrow \sigma}$$

$$\frac{\langle x > 0, \sigma \rangle \rightarrow \mathbf{true} \quad \langle c, \sigma \rangle \rightarrow \sigma' \quad \langle z := x - 1, \sigma' \rangle \rightarrow \sigma'' \quad \langle \mathbf{loop} \ z \ \mathbf{begin} \ c \ \mathbf{end}, \sigma'' \rangle \rightarrow \sigma'''}{\langle \mathbf{loop} \ x \ \mathbf{begin} \ c \ \mathbf{end}, \sigma \rangle \rightarrow \sigma'''}$$

(b)

$\mathfrak{T}_c[\mathbf{loop} \ x \ \mathbf{begin} \ c \ \mathbf{end}] = \mathbf{LOAD}(x); \ \mathbf{STO}(\xi);$
 $\mathbf{LOAD}(\xi); \ \mathbf{PUSH}(0); \ \mathbf{GT}; \ \mathbf{JMPF}(|\mathfrak{T}_c[c]| + 6);$
 $\mathfrak{T}_c[c]; \ \mathbf{LOAD}(\xi); \ \mathbf{PUSH}(1); \ \mathbf{SUB}; \ \mathbf{STO}(\xi); \ \mathbf{JMP}(-(|\mathfrak{T}_c[c]| + 8))$