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### Exercise Sheet 3

**Due date:** November 15<sup>th</sup>. You can hand in your solutions at the start of the exercise class.

**Hint:** Notation is as in the lecture. That is,  $c$  is a program,  $b$  a Boolean expression,  $\sigma$  a program state, etc.

#### Task 1: Operational Equivalence (3 points)

Recall the `repeat  $c$  until  $b$`  construct from Task 2 on Exercise Sheet 2. Prove or disprove:

$$\text{repeat } c \text{ until } b \sim c; \text{ while } b \text{ do } c \text{ end},$$

where  $\sim$  denotes operational equivalence.

#### Task 2: Translation of Statements (2 points)

Define the translation function for the `repeat  $c$  until  $b$`  construct, i.e. define

$$\mathfrak{T}_c[\text{repeat } c \text{ until } b].$$

#### Task 3: loop Loops (2+3 points)

Consider the language construct `loop  $x$  begin  $c$  end` which executes the command  $c$  for  $\max\{x, 0\}$  times. Note that `loop  $x$  begin skip end` should *not change the value of variable  $x$* .

- (a) Define the big step execution relation  $\rightarrow$  for loop loops.
- (b) Define the translation function  $\mathfrak{T}_c[\text{loop } x \text{ begin } c \text{ end}]$  for loop loops.