

Problem Set 10
Comp 301
Spring 2023
22/05/2023 - 26/05/2023

Please use the given code boilerplate for Call by Need and Call by Name languages in Problem 2.

You are not going to make any changes to the code, so submit your answers in a pdf file. Name it as ID_username.pdf with your ID and username (Example: 1234567_hcapuk20.pdf). You are expected to submit your work by May 27 2023 Saturday 23:59. **Read the question carefully. Good luck!**

Problem 1: What does the following program return if we run the program using

- (a) Call by Value?
- (b) Call by Reference?

```
let reset = proc (x) set x = 6 in
  let dec = proc (x) set x = -(x, 1) in
    let a = 7 in
      begin
        (dec a);
        (dec a);
        (reset a);
        (dec a);
        a
      end
    end
```

Problem 2: In the code boilerplate you are given the instrumented versions of Call by Name and Call by Need. The instrumented version allows you to see the state of the environment and store during evaluation. Evaluate the following expressions in top.scm of both languages and briefly explain the behavior.

- (1) For the programs below draw the environment and store diagram both for Call by Need and Call by Name after the red expressions are evaluated.
 - (a) let a=12 in let f=proc(x) begin x; **x**; x end in (f begin set a=-(a, -13); a end)
 - (b) let a=12 in let f=proc(x) begin x; x; x end in (f begin set a=-(a, -13); **a** end)
- (2) **letrec** infinite-loop(c)=(infinite-loop -(c, 1)) in **let** f= **proc** (x) **begin** -(2, 1); 10 **end** in (f (infinite-loop 99))
 - (a) What would happen if you ran the program above in IREF?
 - (b) Did you observe a difference between Call by Name and Call by Need when evaluating the above program, explain the reason briefly.
 - (c) For the program above draw the environment and store diagrams during (f (infinite-loop 99)) is evaluated.