COPL Group Exercise 03, Week Nov 14 - 18

Task 1: Taxonomy of Functions

1. What is the difference between first-class functions and higher-order functions? Give an example for a first-class function and for a higher-order function!
2. Are there first-class/higher-order functions in F1LAE? Justify your answer to this question by pointing out relevant parts in the F1LAE interpreter code!

Task 2: F1LAE with immediate substitution - examples

The first interpreter for F1LAE that we saw used immediate substitution for evaluating let-expressions. Let us look at some example expressions to understand what that means.

1. Define the following mathematical formula "as is" in F1LAE (i.e., not using any let-expressions!): f(x) + g(y), where f(x) = x + c and g(x) = x + 1 + c
2. What happens if you directly execute this expression? What do you have to do in order to execute the expression with, e.g. x=5, y=10, c=2 ? Can you make the expression executable without modifying your original expressions for f(x) and g(x)? If not, what is the problem?

Task 3: Immediate substitution vs deferred substitution

For the language F1LAE, we introduced environments as an alternative for substitutions.

1. Why did we do this?
2. Discuss the advantages and disadvantages of substitution versus environments.
3. Come up with more F1LAE examples that notably behave differently when run with an interpreter that uses substitution versus environments.

Task 4: Scoping

1. What is the difference between dynamic scoping and static (lexical) scoping?
2. What does 'static' stand for in static scoping?
3. What are potential problems with dynamic scoping?