

CSPB 3155 - Reckwerdt - Principles of Programming Languages

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Started on Monday, 17 June 2024, 11:15 PM

State Finished

Completed on Monday, 17 June 2024, 11:17 PM

Time taken 1 min 37 secs

Marks 14.00/14.00

Grade 10.00 out of 10.00 (100%)

Question 1

Correct

Mark 4.00 out of 4.00

Consider the following program in Lettuce:

```
let x = 10 in          (* Line 1 *)  
let f = function (x)  (* Line 2 *)  
    x + 20            (* Line 3 *)  
in  
    x + f(x)          (* Line 4 *)
```

The comments are written between (* and *) markers.

(A) Which of the definitions does the x in line 3 refer to?

- ☐ Line 1
- ☒ Line 2 ✓ Correct
- ☐ Line 4
- ☐ It is an undefined usage

Mark 2.00 out of 2.00

(B) Which of the definitions does the x in line 4 refer to?

- ☒ Line 1 ✓ Correct
- ☐ Line 4
- ☐ It is an undefined usage
- ☐ Line 2

Mark 2.00 out of 2.00

Correct

Marks for this submission: 4.00/4.00.

Question **2**

Correct

Mark 2.00 out of 2.00

What is the value computed by the Lettuce program?

```
let f = function (x) x * x in
  let x = 20 in
    f (10)
```

Answer: 100



Correct

Marks for this submission: 2.00/2.00.

Question **3**

Correct

Mark 5.00 out of 5.00

Let env be the environment

 $\{x : \text{NumValue}(25), f : \text{Closure}(x, \text{Plus}(\text{Ident}("z"), \text{Ident}("x")), \{z : \text{NumValue}(1.0)\}), z : \text{NumValue}(3.1415)\}$

Consider the recursive call:

```
let rec g = function (x)
  if (x <= 0)
  then 1
  else (f(x) + g(x-1)) in ...
```

Let us denote the body of the function g [if $x \leq 0$... else $f(x) + g(x-1)$] as expression **e** and env1 be the environment $\text{ExtendRec}(\text{env}, g, x, \mathbf{e})$

Select all the correct statement from the list below.

Select one or more:

- ☒ a. $\text{env1}(z) = \text{NumValue}(3.1415)$
- ☐ b. $\text{env1}(g)$ is undefined.
- ☒ c. $\text{env1}(x) = \text{env}(x)$ Correct
- ☒ d. $\text{env1}(g) = \text{Closure}(x, \mathbf{e}, \text{env1})$ Correct
- ☐ e. $\text{env1}(x)$ is undefined since x is the formal argument for the definition of g and is resolved only at its call site.

Your answer is correct.

Correct

Marks for this submission: 5.00/5.00.

Question 4

Correct

Mark 3.00 out of 3.00

Let env be an environment

$$\{x : NumValue(25), y : NumValue(30), z : NumValue(40), f : Closure("x", Plus(x, Const(10)), env2)\}.$$

Suppose we wish to extend env to handle a recursive function call

```
let rec f = e in ...
```

Let $env1$ denote the environment $ExtendRec(env, f, x, e)$ Which of the following values is obtained when we lookup f in $env1$?

Select one:

- ☒ a. $Closure(x, e, env1)$
- ☐ b. The lookup will return an "Unknown Identifier" error.
- ☐ c. $NumValue(v)$, wherein v is the result of evaluating e under env
- ☐ d. $Closure(x, e, env)$



Your answer is correct.

Correct

Marks for this submission: 3.00/3.00.