CSPB 3155 - Reckwerdt - Principles of Programming Languages

Started on	Monday, 17 June 2024, 11:05 PM
State	Finished
Completed on	Monday, 17 June 2024, 11:07 PM
Time taken	1 min 54 secs
Marks	25.00/25.00
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 2 Correct
- ( ) It is an undefined usage
- ( ) Line 1
- ( ) Line 4

Mark 2.00 out of 2.00

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

- ( ) Line 2
- ( ) It is an undefined usage
- (•) Line 1 Correct
- ( ) Line 4

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

Consider the Lettuce program below:

```
let x = 10 in
    let y = x + 10 in
      let z = x * y in
              2 * z
```

What value does it evaluate to?

Answer: 400

Correct

Correct

Marks for this submission: 2.00/2.00.

Question **3**

Correct

Mark 2.00 out of 2.00

What is the value computed by the following Lettuce program:

```
let x = 10  in
  let y =  let x = 10 in x + 10 in
     let z = let x = 20 in x + 10 in
               x
```

Just type the number in the box below.

Answer: 10

Correct

Marks for this submission: 2.00/2.00.

Question **4**

Correct

Mark 2.00 out of 2.00

What is the value computed by the following Lettuce program:

```
let x = 10  in
  let y =  let x = 10 in x + 10 in
     let z = let x = 20 in x + 10 in
               z
```

Answer: 30

Correct

Marks for this submission: 2.00/2.00.

Question **5**

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 **6**

Correct

Mark 5.00 out of 5.00

Consider Let Bindings in lettuce. Consider the following operational semantic rule:

$$\frac{\textbf{eval}(e_1,\sigma) = v_1, \quad \textbf{eval}(e_2,\sigma) = v_2, \quad v_1 \neq \textbf{error}}{\textbf{eval}(Let(id,e_1,e_2),\sigma) = v_2}$$

What is the value of the following program under these semantics:

The remaining semantic rules are as in the "Lettuce-Let Language" notebook. Specifically, the semantics for Constants and Identifiers are recalled here:

$$\frac{}{eval(\texttt{Const(v)},\sigma) = v}\text{(const-rule)}$$

$$\frac{x \in \text{domain}(\sigma)}{eval(\texttt{Ident(x)},\sigma) = \sigma(\texttt{x})}\text{(ident-ok-rule)} \qquad \frac{x \notin \text{domain}(\sigma)}{eval(\texttt{Ident(x)},\sigma) = \textbf{error}}\text{(ident-nok-rule)}$$

```
let x = 10 in
       x
```

Select one:

- a. 10
- b. false
- c. 20
- d. **error**
- e. true

Your answer is correct.

Correct

Marks for this submission: 5.00/5.00.

Question **7**

Correct

Mark 5.00 out of 5.00

Consider Let Bindings in lettuce. Consider once again the following operational semantic rule:

$$\frac{\mathbf{eval}(e_1,\sigma) = v_1, \quad \mathbf{eval}(e_2,\sigma) = v_2, \quad v_1 \neq \mathbf{error}}{\mathbf{eval}(Let(id,e_1,e_2),\sigma) = v_2}$$

Which of the statement best describes the shortcoming of this semantic rule?

Select one:

- a. The rule should add the values computed by e1 and e2
- b. The rule must check if e2 is an error before it evaluates e1
- c. The rule must also check if e1 is an error, and if so return error.
- d. The rule does not bind id to the value computed by expression e1, when evaluating e2.
- e. The rule is correct

Your answer is correct.

Correct

Marks for this submission: 5.00/5.00.

Question **8**

Correct

Mark 3.00 out of 3.00

Suppose we add a new operator $\sqrt{x}$ denoted by $\mathrm{Sqrt}(\mathbf{Expr})$ in Lettuce. Note that $\sqrt{x}$ requires its argument x to be non-negative. Select which of the options below are the appropriate big-step operational rules for evaluating square-root.

$$\frac{\mathbf{eval}(e,\sigma) = v_1,\ \ v_1 \in R,\ \ v_1 \geq 0}{\mathbf{eval}(Sqrt(e),\sigma) = \sqrt{v_1}}\ (\mathbf{A})$$

$$\frac{\mathbf{eval}(e,\sigma) = v_1,\ \ v_1 \in R}{\mathbf{eval}(Sqrt(e),\sigma) = v_1^2}\ (\mathbf{B})$$

$$\frac{\mathbf{eval}(e,\sigma) = v_1,\ \ v_1 \in R}{\mathbf{eval}(Sqrt(e),\sigma) = \sqrt{v_1}}\ (\mathbf{C})$$

$$\frac{\mathbf{eval}(e,\sigma) = v_1,\ \ v_1 \in R,\ \ v_1 < 0}{\mathbf{eval}(Sqrt(e),\sigma) = \mathbf{error}}\ (\mathbf{D})$$

$$\frac{\mathbf{eval}(e,\sigma) = v_1,\ \ v_1 \in R,\ \ v_1 \leq 0}{\mathbf{eval}(Sqrt(e),\sigma) = \mathbf{error}}\ (\mathbf{E})$$

$$\frac{\mathbf{eval}(e,\sigma) = v_1,\ \ v_1 \notin R}{\mathbf{eval}(Sqrt(e),\sigma) = \mathbf{error}}\ (\mathbf{F})$$

$$\frac{\mathbf{eval}(e,\sigma) = v_1,\ \ v_1 \notin R}{\mathbf{eval}(Sqrt(e),\sigma) = \mathbf{0}}\ (\mathbf{G})$$

Select one or more:

- [x] a. A
- [x] b. B
- [x] c. C
- [x] d. D
- [x] e. E
- [x] f. F
- [x] g. G

Your answer is correct.

Correct

Marks for this submission: 3.00/3.00.