

CSPB 3155 - Reckwerdt - Principles of Programming Languages

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Started on Friday, 24 May 2024, 4:19 PM

State Finished

Completed on Friday, 24 May 2024, 4:26 PM

Time taken 6 mins 55 secs

Marks 30.00/30.00

Grade 10.00 out of 10.00 (100%)

Question 1

Correct

Mark 4.00 out of 4.00

From the set of functions given, select all the tail recursive ones.

Select one or more:

☐

a.

```
def g(x: Int, y : Int ): Int = {  
    if (x <= 1) { y + 1 }  
    else { 15 * g(x - 1, x + y - 2) }  
}
```

☐

b.

```
def f(x: Int): Int = {  
    if (x % 2 == 0) { 1 }  
    else { 1 + f (x + 1) }  
}
```

☒

c.

```
def g(x: Int, y : Int ): Int = {  
    if (x <= 1) { y + 1 }  
    else { g(x-1, x + y - 2) }  
}
```

☐

d.

```
def g(x: Int, y : Int ): Int = {  
    if (x <= 1) { y + 1 }  
    else { g(x-2, g(x-1, x + y - 2)) }  
}
```

☒

e.

```
def f(x: Int): Int = {  
    if (x % 2 == 0) { 1 }  
    else { f (x + 1) }  
}
```

Your answer is correct.

Correct

Marks for this submission: 4.00/4.00.

Question 2

Correct

Mark 7.00 out of 7.00

For the following question recursion depth is defined as follows: The first call is depth one, the initial recursive call goes on to depth 2, etc.

Consider the following recursive function introduced in class (assume that the tail recursion has not been optimized by the compiler)

```
def isPowerOfTwo(x: Int): Boolean = {  
  if (x == 0) { return false }  
  else if (x == 1) { return true }  
  else if (x % 2 == 1){ return false }  
  else { return isPowerOfTwo(x/2) }  
}
```

What is the depth of the recursion for

isPowerOfTwo(140)

3

Which of the numbers below will yield a stack depth of $n + 1$ for all n ?

- ☐ 3^n
- ☒ 2^n Correct
- ☐ $5n$
- ☐ 5^n
- ☐ $\log_2(n)$

Mark 2.00 out of 2.00

Now consider another function

```
def recurseToPowerOfTwo(x: Int): Int = {  
  if (isPowerOfTwo(x)) { return x }  
  else { recurseToPowerOfTwo(x + 1) }  
}
```

What is the recursion depth for the call (just count recursive calls to the function recurseToThePowerOfTwo, and do not count calls to isPowerOfTwo)?

recurseToPowerOfTwo(11)

6

Which of the following inputs will yield a recursion depth of 2^n ?

- ☐ 2^n
- ☐ $2^n - 1$

- ☐ None of the choices are correct
- ☐ $3n$
- ☒ $2^n + 1$ correct

Mark 3.00 out of 3.00

Correct

Marks for this submission: 7.00/7.00.

Question 3

Correct

Mark 3.00 out of 3.00

Consider the following recursive function below:

```
def addNumbersUptoN(n: Int): Double = {  
    if (n <= 0) { 0.0 }  
    else { (1.0/n) + addNumbersUptoN(n-1) }}
```

Select the correct tail recursive version of this function.

Select one:

- ☐ a.

```
def addNumbersUptoN(n: Int, a : Int = 0): Double = {  
    if (n <= 0) { a }  
    else { addNumbersUptoN(n-1, a + 1.0/n) }  
}
```
- ☒ b.

```
def addNumbersUptoN(n: Int, a : Double = 0.0): Double = {  
    if (n <= 0) { a }  
    else { addNumbersUptoN(n-1, a + 1.0/n) }  
}
```
- ☐ c.

```
def addNumbersUptoN(n: Int, a :Double = 0): Double= {  
    if (n == 0) { a }  
    else { 1.0/n + addNumbersUptoN(n-1, a + 1.0/n) }  
}
```
- ☐ d.

```
def addNumbersUptoN(n: Int, a : Int = 0): Int = {  
    if (n <= 0) { 0 }  
    else { addNumbersUptoN(n-1, a + 1.0/n) }  
}
```

Correct

Your answer is correct.

Correct

Marks for this submission: 3.00/3.00.

Question **4**

Correct

Mark 4.00 out of 4.00

We will define the following grammar:

$$\mathbf{A} \rightarrow H(H(\mathbf{B})) \mid Z$$
$$\mathbf{B} \rightarrow L(\mathbf{A}) \mid Y$$

The start symbol is **A**. Which of the following terms can be generated by the grammar?

Select one or more:



a.

 $H(H(L(H(H(Y)))))$ b. $H(L(Y))$ 

c.

 $H(H(H(H(Y))))$ 

d.

 Y 

e.

 $H(H(Y))$ 

f.

 $H(H(L(Z)))$ 

g.

 Z

Your answer is correct.

Correct

Marks for this submission: 4.00/4.00.

Question 5

Correct

Mark 4.00 out of 4.00

Consider the grammar below:

A $\rightarrow H(\mathbf{B}) \mid Z$

B $\rightarrow L(\mathbf{A}) \mid Y$

Which of the following is the correct definition in scala?

Select one:

☐

a. sealed trait A
sealed trait B
case class Z() extends A
case class H(a: A) extends A
case class Y() extends B
case class L(a: A) extends B

☐

b. sealed trait A
case class Z() extends A
case class H(a: A) extends A
case class Y() extends A
case class L(a: A) extends A

☐

c. sealed trait A
sealed trait B
case class Z() extends B
case class H(a: A) extends B
case class Y() extends A
case class L(a: A) extends A

☒

d. sealed trait A
sealed trait B
case class Z() extends A
case class H(b: B) extends A
case class Y() extends B
case class L(a: A) extends B

Your answer is correct.

Correct

Marks for this submission: 4.00/4.00.

Question 6

Correct

Mark 8.00 out of 8.00

Consider the grammar:

 $A \rightarrow Z \mid S(A) \mid T(A, B)$ $B \rightarrow Y$

Complete the scala definition by dragging and dropping appropriate choices

```
sealed trait A
sealed trait 
case object Z extends 
case class S() 
case class T() 
case object  extends B
```

Complete the terms below so that they are generated by the grammar with start symbol **A** :1. $S(T(Z, \text{)))$ 2. $S(\text{}(Z, Y))$ 3. $T(\text{}(\text{}(Z)), Y)$

| | | | | | | | |
|-------------|-----------|-----------------|-----|-----|-----------|---------|---|
| b:B | class Y | a: A, b: B | Z | a:A | extends A | Y | C |
| a1:A, a2: A | extends B | a: A, b: B, c:C | c:A | B | A | class Z | |

Y Z T S R

Your answer is correct.

Correct

Marks for this submission: 8.00/8.00.