CS1101S Programming Methodology

Reading Assessment 1 from AY2017/18
adapted to CS1101S 2019/20

Use **only** the given answer sheet to indicate your answer to each of the following 15 questions. Use a pencil, and mark only one choice for each question. Do not write your name, but only your student number, on the answer sheet.

1 Scoping

Question 1:
What is the result of evaluating the following Source program:

```
const x = 75;
function f(y) {
    return x + 2;
}
f(x + 25);
```

1 [A] 25

1 [B] 75

1 [C] 77

1 [D] 100

1 [E] `Undeclared name x`

Question 2:
What is the result of evaluating the following Source program:

```
const x = 1;
function f(x) {
    return x + 2;
}
f(3);
```

2 [A] 3

2 [B] 4

2 [C] 5

2 [D] `Undeclared name f`

2 [E] `Undeclared name x`

Question 3: What is the result of evaluating the following Source program:

```
function f(x) {
    return x => x + 1;
}
f(2)(3);
```

3 [A] 1

3 [B] 2

3 [C] 3

3 [D] 4

3 [E] `Undeclared name x`

Question 4: What is the result of evaluating the following Source program:

```
function f(g, x) {
     return g(g(x));
}
f(y => x + 1, 2);
```

4 [A] 4

4 [B] 3

4 [C] 2

4 [D] `Undeclared name g`

4 [E] `Undeclared name x`

Question 5: What is the result of evaluating the following Source program:

```
const x = 10;
function f(x) {
    function g(x) {
        return x + 20;
    }
    g(30);
    return x + 40;
}
f(50);
```

5 [A] 50

5 [B] 60

5 [C] 70

5 [D] 80

5 [E] 90

2 Processes

Question 6: To what kind of process does the following Source program give rise to?

```
function f(x) {
    if (x < 10) {
        return x;
    } else {
        return f(x / 2);
    }
}
f(200);
```

6 [A] iterative process

6 [B] recursive process

6 [C] no process: there is a syntax error

6 [D] infinite process

6 [E] production process

Question 7: To what kind of process does the following Source program give rise to when a positive integer is passed as argument?

```
function p(x) {
    if (x <= 10) {
        return p(x * 10);
    } else {
        return p(x - 1);
    }
}
p(200);
```

7 [A] no process: there is a syntax error

7 [B] recursive process

7 [C] illegal process

7 [D] infinite process

7 [E] production process

Question 8: To what kind of process does the following Source program give rise to?

```
function g(x) {
    if (x < 10) {
        return x;
    } else {
        return g(x / 2) * 2;
    }
}
g(200);
```

8 [A] iterative process

8 [B] recursive process

8 [C] no process: there is a syntax error

8 [D] infinite process

8 [E] production process

Question 9: To what kind of process does the following Source program give rise to?

```
function j(x) {
  return k(x) - 1;
}
function k(x) {
  if (x === 0) {
    return 1;
  } else {
    return j(x - 1);
  }
}
k(200);
```

9 [A] iterative process

9 [B] recursive process

9 [C] no process: there is a syntax error

9 [D] infinite process

9 [E] production process

Question 10: To what kind of process does the following Source program give rise to?

```
function is_even(x) {
    return x % 2 === 0;
}

function q(x) {
  if (x <= 1) {
    return 0;
  } else if (is_even(x)) {
    return q(x / 2) + 1;
  } else {
    return q(x - 1);
  }
}
q(200);
```

10 [A] iterative process

10 [B] recursive process

10 [C] no process: there is a syntax error

10 [D] infinite process

10 [E] production process

3 Correctness

Question 11: We specify that a function *zero* should always return the number 0 when applied to any argument value. Consider the following implementation.

```
function zero(x) {
  return "zero";
}
```

Which one of the following statements is correct?

11 [A] The function `zero` does not meet the specification for any argument.

11 [B] The function `zero` meets the specification only for some arguments.

11 [C] The function `zero` meets the specfication.

11 [D] The program does not define a function `zero`.

11 [E] The program has a syntax error.

Question 12: Recall that there are only two boolean values, `true` and `false`. We are specifying that the function `not` should be applied to a boolean value `b` and return a boolean value that is not `b`. Consider the following implmentation.

```
function not(b) {
    if (b) {
      return false;
    } else {
      return b;
    }
}
```

Which one of the following statements is correct?

12 [A] The function `not` does not meet the specification for any argument.

12 [B] The function `not` meets the specification only for the argument `true`.

12 [C] The function `not` meets the specfication only for the argument `false`.

12 [D] The function `not` meets the specfication.

12 [E] The program has a syntax error.

Question 13: Consider the following specification of the triple function, defined on numbers:

$$triple(x) = 3x$$

For example, *triple*(10) is 30.
The following function is proposed as an implementation of *triple*.

```
function triple(n) {
    if (n === 0) {
      return 0;
    } else {
      return n + n + n;
    }
}
```

Which one of the following statements is correct?

13 [A] The function `triple` does not meet the specification for any argument.

13 [B] The function `triple` meets the specification only for the argument 0.

13 [C] The function `triple` meets the specfication only for non-zero arguments.

13 [D] The function `triple` meets the specfication.

13 [E] The program has a syntax error.

Question 14: Consider the following specification of the tribonacci numbers T_i: $T_1 = 1, T_2 = 1, T_3 = 2$ and for any other positive integer n,

$$T_n = T_{n-1} + T_{n-2} + T_{n-3}$$

The following function `T` is proposed as an implementation of T.

```
function T(n) {
    if (n === 1) {
      return 1;
    } else if (n === 2) {
      return 1;
    } else if (n === 3) {
      return 2;
    } else {
      return T(n - 1) + T(n - 2) + T(n - 3);
    }
}
```

Which one of the following statements is correct?

14 [A] The function `T` does not meet the specification for any argument value.

14 [B] The function `T` meets the specification only for the numbers 1, 2 and 3.

14 [C] The function `T` meets the specfication.

14 [D] The function `T` meets the specfication for even argument values, but not for odd argument values.

14 [E] The program has a syntax error.

Question 15: Which one of the following statements is **false**?

15 [A] For a given specification, there can be two correct implementations.

15 [B] A specification can be written in English, with no formula.

15 [C] An implementation is considered correct if it meets the specification for most of the specified values.

15 [D] An implementation can be correct even if it is unnecessarily complicated.

15 [E] An implementation can be correct even if it is slower than other correct implementations.