CM1601: Programming Fundamentals

School	School of Computing
Course	BSc (Hons) Artificial Intelligence and Data Science
Stage	Year 1
Academic Year	2021
Semester	Semester 2
Date	2nd August 2021
Start Time	2pm
End Time	4pm
Duration	120 mins
No. of Pages (including cover sheet)	12

Instructions to Candidates

You are advised (but not required) to spend the first ten minutes of the examination reading the questions and planning how you will answer those you have selected.

This examination paper comprises 3 sections. Answer all the questions

Section A (30 Marks)

Section B (35 Marks)

Section C (35 marks)

THIS PAPER MUST NOT BE TAKEN OUT OF THE EXAMINATION ROOM
DO NOT TURN OVER THIS PAGE UNTIL THE INVIGILATOR INSTRUCTS YOU TO DO SO

Special Stationery (if applicable)
You may make use of a non-programmable calculator in this exam.

Section A

QUESTION 1

All keywords in Java are in

A) Uppercase

B) Lowercase

C) Capitalized

D) None of the above

QUESTION 2

Which is the correct statement

A) In python, a dictionary can have two same keys with different values.

B) In python, a dictionary can have two same values with different keys

C) In python, a dictionary can have two same keys or same values but cannot have two same key-value pair

D) In python, a dictionary can neither have two same keys nor two same values.

QUESTION 3

Which of the function header is valid?

```
A) def fun(a = 2, b = 3, c)

B) def fun(a = 2, b, c = 3)

C) def fun(a, b = 2, c = 3)

D) def fun(a, b, c = 3, d)
```

QUESTION 4

Guess the output of the following program?

```
list1=[0,2,5,1]
str1="7"
for i in list1:
     str1=str1+i

print(str1)
```

A) 70251

B) 7

C) 15

D) Compilation error

QUESTION 5

Predict the output of the following program?

```
list1 = [1, 2, 3, 4, 5]
list2 = list1
list2[0] = 0;
print ("list1= : ", list1)
```

A) list1= :   [0, 2, 3, 4, 5]

B) list1= :   [1, 2, 3, 4, 5]

C) Compilation error

D) Non of the above

QUESTION 6

Guess the output of the following program?

```
i = 0
while i < 3:
   print(i,end=" ")
   i+=1
   print(i+1, end=" ")
```

A) 0 2 1 3 2 4

B) 0 1 2 3 4 5

C) Error

D) 1 0 2 4 3 5

QUESTION 7

Which of the following is an invalid statement?

A) `xyz = 1,000,000`

B) `x y z = 1000 2000 3000`

C) `x,y,z = 1000, 2000, 3000`

D) `x_y_z = 1,000,000`

QUESTION 8

What will be the output of the following program?

```
def test_func(value, values):
    value = "10"
    values[0] = 44

t = "3"
v = [1, 2, 3]
test_func(t, v)
print(t, v[0])
```

A) 1 1

B) 10 44

C) 3 1

D) 3 44

QUESTION 9

Guess the output of the following statements

```
a = 2
b = '3.77'
c = -8
str1 = '{0:.4f} {0:3d} {2} {1}'.format(a, b, c)
print(str1)
```

a) 2.0000 2 -8 3.77

b) 2 3.77 -8 3.77

c) 2.000 3 -8 3.77

d) 2.000 2 8 3.77

QUESTION 10

Guess the output of the following program

```
i = 1
while  True:
    if  i % 3  ==  0:
        break
    print(i)
    i + = 1
```

A) 1 2 3.

B) 1 2.

C) Syntax Error.

D) None of these

QUESTION 11

Which of the following will be the infinite loops?

A) for(; ;)

B) for(i=0 ; i<1; i--)

C) for(i=0; ; i++)

D) All of the above

QUESTION 12

What will be the output of the following program?

```
class Tree { }
class Pine extends Tree { }
class Oak extends Tree { }
public class Forest1
{
```

```
    public static void main (String [] args)
    {
        Tree tree = new Pine();
        if( tree instanceof Pine )
            System.out.println ("Pine");
        else if( tree instanceof Tree )
            System.out.println ("Tree");
        else if( tree instanceof Oak )
            System.out.println ( "Oak" );
        else
            System.out.println ("Oops ");
    }
}
```

A) Pine

B) Tree

C) Forest

D) Oops

QUESTION 13

Guess the output of the following program.

```
int i=0;
int j=7;
for(; (i<5) && (j++<10); i++){
    System.out.println(i+" "+j);
}
 System.out.println(i+" "+j);
```

A) 0 7 1 8 2 9 3 10

B) 0 8 1 9 2 10 3 11

C) 0 8 1 9 2 10 2 10

D) Compilation error

QUESTION 14

Predict the result

```
public class TestClass {
        public static void main(String[] args) {
        List<String> items = new ArrayList<>();
        items.add("Pen");
        items.add("Pencil");
        items.add("Box");
        for (String i : items) {
            if (i.indexOf("P") == 0) {
                continue;
            }
            else {
                System.out.print(i+" ");
            }
         }
        }
    }
```

A) Pen Pencil Box

B) Pen Pencil

C) Box

D) Compilation fails.

QUESTION 15

Which one of these lists contains only java programming language keywords?

A) class, if, void, long, Int, continue

B) goto, instanceof, native, finally, default, throws

C) try, virtual, throw, final, volatile, transient

D) strictfp, constant, super, implements, do

(2 * 15 = 30 marks)

Section B

Answer the following questions briefly.

QUESTION 1

Complete the following Table.

Collection Type	Ordered	Indexed	Modifiable	Duplication
Sets			✓	
Lists	✓	✓	✓	✓
Tuples	✓	✓		✓
Dictionaries		✓	✓	

The main difference between Python's while and for loops is that while loops are used for conditional repetition, while for loops are used for iterating over sequences of values. A while loop repeats a set of statements while a certain condition is true, while a for loop executes once for each value in a sequence, such as a list or a range of numbers.

(4 marks)

QUESTION 2

Explain the main difference of Python while and for loop

(2 marks)

QUESTION 3

Explain types of variables in Python based on its scope.

(3 marks)

Implicit casting, also known as widening, is when a data type of smaller size is automatically converted into a data type of larger size

QUESTION 4

What is implicit and explicit data type casting in java? Explain using an example.

Explicit casting, also known as narrowing, is when a data type of larger size is manually converted into a data type of smaller size.

(3 marks)

QUESTION 5

Explain how java achieves platform independence

(3 marks)

QUESTION 6

Figure out the output of the following program. Explain the reason behind the output

```
x = [7, 8]
for i in x:
    x.append(i+1)
print(x)
```

In the case of Java, code is compiled into bytecode, which is an intermediate language that is understood by the Java Virtual Machine (JVM). The JVM is available on various platforms, such as Windows, Linux, and macOS, and provides a consistent environment for running Java programs. This means that a Java program compiled on one platform can be executed on any platform that has a compatible JVM installed, without requiring any changes to the code.

(5 marks)

QUESTION 7

Explain why you receive 2 different outputs for the following 2 programs

Program 1

```
def string_concat(para):
    para="changed"
para="original"
string_concat(para)
print(para)
```

In Program 1, para is a string variable that is passed as an argument to the string_concat function. Within the function, the value of para is first assigned the string "changed" and then immediately reassigned to the string "original". The function is then recursively called with the updated value of para. However, since there is no base case to end the recursion, this results in an infinite loop and the program will never terminate.

Program 2

```
def string_concat(para):
    para[0]="changed"
para = "original"
para_list=[para]
string_concat(para_list)
print(para_list[0])
```

In Program 2, para is a list containing a single string element that is passed as an argument to the string_concat function. Within the function, the first character of the string in para is modified to "changed" using list indexing, and then the variable para is reassigned to a new string "original". However, this new assignment of para only affects the local variable within the function, and does not modify the original list passed as an argument.

(5 marks)

QUESTION 8

Guess the output. Explain the flow of the code.

```
public class MySuper {

    int x = 1;
    int y = 6;

    MySuper() {
        System.out.print("-x" + x);
        new MySuper(5);
    }
    MySuper(int y) {
        System.out.print("-y" + y);
        x = 4;
    }
}


public class MySub extends MySuper {

    int w = 4;

    MySub(int w) {
        System.out.print("-w" + w);
    }
    public static void main(String[]
        MySub mySub = new MySub(2);
    }
}
```

In this code, there are two classes: MySuper and MySub. MySuper has two instance variables x and y, and two constructors. The first constructor initializes x to 1, prints "-x1" to the console, and then creates a new instance of MySuper with an argument of 5. The second constructor takes an integer argument and initializes y to that value, sets x to 4, and then prints "-y" followed by the value of the integer argument passed to the constructor.

MySub extends MySuper and has one instance variable w and one constructor that takes an integer argument. The constructor initializes w to the value of the integer argument and then prints "-w" followed by the value of w.

In the main method of MySub, a new instance of MySub is created with an argument of 2. This invokes the constructor of MySub, which initializes w to 2 and prints "-w2". Since MySub extends MySuper, the default constructor of MySuper is also invoked when a new instance of MySub is created. This prints "-x1" and creates a new instance of MySuper with an argument of 5, which in turn initializes x to 4 and prints "-y5".

Therefore, the final output of the program will be "-x1-y5-w2".

(5 marks)

QUESTION 9

Explain the reason behind the output.

```java
public static void main(String [] args)
    {
        int x= 0;                              output is 8 5
        int y= 0;
        for (int z = 0; z < 5; z++)
        {
            if (( ++x > 2 ) || (++y > 2))
            {
                x++;
            }
        }
        System.out.println(x + " " + y);
    }
```

(5 marks)

Section 3

QUESTION 1

Implement the Java classes (with full details of fields and constructors) which are required to simulate the following problem. Use Java to provide the solution.

A restaurant is located in a city, it has a specific address, a name, a menu (a number of daily dishes) and an unlimited number of customers visiting it every day. Each customer lives in a city, has a first name, a surname, a date of birth, an employer and exactly 3 favorite restaurants. Each city has a name and a number of restaurants.

(10 marks)

QUESTION 2

The following implementation comments on the braking pattern of an autonomous vehicle. Please note that these values are just for the simulation purpose and the distance between the vehicle and the obstacle is a constant. Valid input range for speed is 1kmph to 100kmph. But the function is only working for some inputs while it is giving "Invalid input" for valid speed parameters.

```java
public void calculateBrakingDistance(int speed){
```

```
switch(distance){
  case 100:
      System.out.print("Break very hard");
      break;

  case 70:
      System.out.print("Break hard");
      break;

  case 40:
      System.out.print("Break gradually ");
      break;

  case 20:
      System.out.print("break smoothly. You have time");
      break;

  default:
      System.out.print("Invalid input");
      break;
  }
```
switch statement using variable distance instead of
speed

A. Why the programmer is getting unexpected results here?
B. Provide the correct implementation. You can have your own assumptions when correcting the code.
C. Add a test plan to cover the scenario. Test cases need to have a description, input, and expected result. You do not need to add the status of the test cases as it is not required to implement the test cases.

(2+5+3 marks)

QUESTION 3

The additive persistence of an integer, n, is the number of times you have to replace n with the sum of its digits until n becomes a single digit integer. The multiplicative persistence of an integer, n, is the number of times you have to replace n with the product of its digits until n becomes a single digit integer. Create a function that takes an integer as an argument and produces its addictive persistence.

Eg
additivePersistence(1679583) ➝ 3

```
// 1 + 6 + 7 + 9 + 5 + 8 + 3 = 39
// 3 + 9 = 12
// 1 + 2 = 3
// It takes 3 iterations to reach a single-digit.
```

Feel free to use Python or Java to write the solution.

```java
public static int additivePersistence(int n) {
    int persistence = 0;
    while (n >= 10) {
        int sum = 0;
        while (n > 0) {
            sum += n % 10;
            n /= 10;
        }
        n = sum;
        persistence++;
    }
    return persistence;
}
```

```java
    public void calculateBrakingDistance(int speed){
    if (speed >= 1 && speed <= 20) {
        System.out.print("Break smoothly. You have time");
    } else if (speed > 20 && speed <= 40) {
        System.out.print("Break gradually");
    } else if (speed > 40 && speed <= 70) {
        System.out.print("Break hard");
    } else if (speed > 70 && speed <= 100) {
        System.out.print("Break very hard");
    } else {
        System.out.print("Invalid input");
    }
    }
```

Test Case 1 - Input at the minimum valid speed of 1 kmph   Exam Period: August 2020
Description: Testing the function with the minimum valid input
Input: 1
Expected Result: Break smoothly. You have time

Test Case 2 - Input at the maximum valid speed of 100 kmph
Description: Testing the function with the maximum valid input
Input: 100
Expected Result: Break very hard **(15 marks)**

Test Case 3 - Input at a speed between 1-20 kmph
Description: Testing the function with an input within the first range
Input: 10
Expected Result: Break smoothly. You have time

Test Case 4 - Input at a speed between 20-40 kmph
Description: Testing the function with an input within the second range
Input: 30
Expected Result: Break gradually

Test Case 5 - Input at a speed between 40-70 kmph
Description: Testing the function with an input within the third range
Input: 50
Expected Result: Break hard

Test Case 6 - Input at a speed between 70-100 kmph
Description: Testing the function with an input within the fourth range
Input: 80
Expected Result: Break very hard

Test Case 7 - Input at a speed below the minimum valid speed
Description: Testing the function with an input below the minimum valid speed
Input: 0
Expected Result: Invalid input

Test Case 8 - Input at a speed above the maximum valid speed
Description: Testing the function with an input above the maximum valid speed
Input: 120
Expected Result: Invalid input

END OF QUESTION PAPER