S228/211C, S282/211C

DUBLIN INSTITUTE OF TECHNOLOGY

DT228 BSc. (Honours) Degree in Computer Science

Year 2

DT282 BSc. (Honours) Degree in Computer Science (International)

Year 2

SUMMER EXAMINATIONS 2015/2016

OBJECT ORIENTED PROGRAMMING [CMPU2016]

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THURSDAY 12TH MAY 9.30 A.M. - 12.30 P.M.

THREE HOURS

INSTRUCTIONS TO CANDIDATES
ANSWER **FOUR** QUESTIONS OUT OF **SIX**. ALL QUESTIONS CARRY EQUAL MARKS.

Question 1

(a) Give an example of the usage of each of the following features of the Processing language:

i. `mouseX` and `mouseY`
ii. `PVector`
iii. `pushMatrix` and `popMatrix`

(6 marks)

```
2008,97,15,102,28,33,76,111,192.4,114,93,45,39
2009,62,56,26,71,76,64,165,70,24,63,171,70
2010,45,37,55,27,38,50,79,48,104,31,100,58
```

(b) Figure 1 shows an extract from a comma separated file of rainfall amounts recorded at a weather station over a 12-month period. Each row from the file represents a year of data. The first field is the year, while the raining 12 values are the rainfall values by month recorded in mm.


```
2008,97,15,102,28,33,76,111,192.4,114,93,45,39
2009,62,56,26,71,76,64,165,70,24,63,171,70
2010,45,37,55,27,38,50,79,48,104,31,100,58
```


Figure 1

Write code for class called `RainFall` that encapsulates the data from a single row of the file. In your solution, include a constructor that takes a parameter of a single line from the file and parses it to assign values to the fields in the class.

(8 marks)

(c) Write code for a method called `void graphRainfall(Rainfall rainFall)`. This method should draw a bar chart of the data held the `Rainfall` parameter passed into the method. The barchart should fill the width and height of the screen. You do not need to include code for axis drawing or labelling in your solution.

(11 marks)

Question 2

Figure 2 shows a screenshot from a Processing sketch that implements a 2D two-player space shooter game similar to *SpaceWar*.

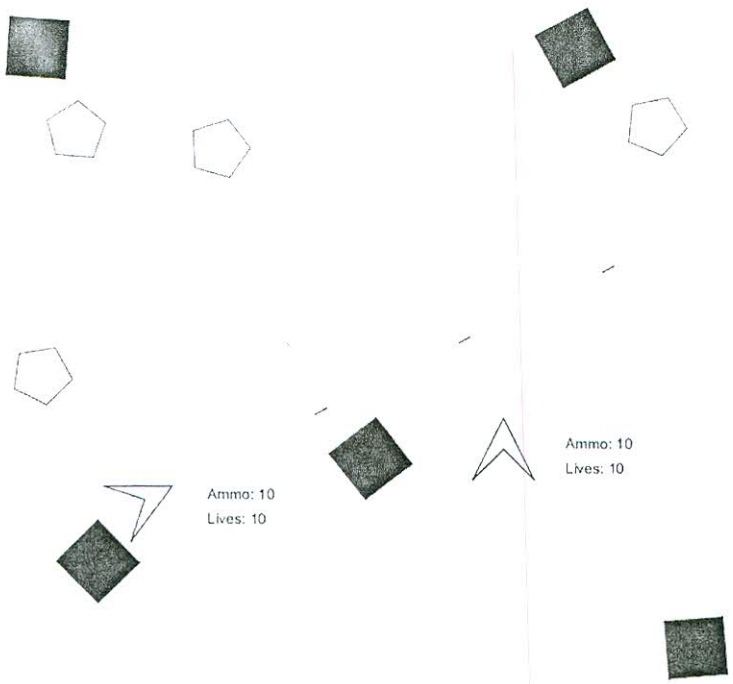

Figure 2

(a) How can *polymorphism* be used in the implementation of a game such this?

(8 marks)

(b) How would you use *PVector*s to implement player movement and orientation in this game?

(8 marks)

(c) How would you check for collisions between the bullets and the player?

(9 marks)

Question 3

(a) Describe what is happening in the code extract given in Figure 3. What gets printed out?

```
void setup()
{
  float f = 10;
  float g = 20;
  f = g;
  g = 30;
  println(f);
  Test ff = new Test(10);
  Test gg = new Test(20);
  ff = gg;
  gg.a = 30;
  println(ff.a);
}

class Test
{
  float a;
  Test(float a)
  {
    this.a = a;
  }
}
```

Figure 3

(10 marks)

(b) What are *access modifiers* in Java used for? Include examples in your solution.

(6 marks)

(c) What is meant by the keyword `static` when applied to a field in Java?

(2 marks)

(d) Describes the steps involved in setting up a new Java code repository on github and committing some code to the repository.

(7 marks)

Question 4

(a) What is the minimum number of edit operations required to make the string DEFEFDD into the string EFDFDBED? Construct a Levenshtein distance matrix to solve this.

(7 marks)

(b) Figure 4 presents an extract from a class that encapsulates a dynamic 2D matrix of floats in Java.

```
package ie.dit;

public class Matrix
{
    private float[][] elements;
    private int rows;
    private int cols;
    public int getRows()
    {
        return rows;
    }
    public int getCols()
    {
        return cols;
    }
    public Matrix(int rows, int cols)
    {
        this.rows = rows;
        this.cols = cols;
        elements = new float[rows][cols];
    }
    public void setElement(int row, int col, float value)
    {
        elements[row][col] = value;
    }
    public float getElement(int row, int col)
    {
        return elements[row][col];
    }
    ...
    ...
```

Figure 4

Answer the following questions about the code:

i. What is the significance of the line `package ie.dit;` at the top of the file?

(2 marks)

ii. What is the significance of the methods `getRows()` and `getCols()`? Are these methods useful in this context?

(3 marks)

iii. Should this class implement a default constructor? Include a justification for your answer.

(3 marks)

(c) Making use of the `Matrix` class given in Figure 4 write the implementation for the method:

```
public static float LevenshteinDistance(String needle, String
haystack);
```

The purpose of this method is to return the *Levenshtein Distance* between the two `String` parameters.

(10 marks)

Question 5

(a) Give examples for the following features of the Java programming language:

i. *Anonymous Inner Classes*

(7 marks)

ii. *Exceptions*

(8 marks)

(b) Figure 5 shows an extract from a Java program. Explain each numbered line of code in this extract in detail.

```
1. File[] files = new File(src).listFiles(new FileFilter()
        {
2.      public boolean accept(File f)
              {
3.          return (f.getName().toLowerCase().endsWith(".txt"));
              }
        });

4. if (files == null)
   {
5.    System.out.println("No files found");
6.    return;
   }
7. for (File file : files)
   {
8.  if (file.isFile())
    {
9.          processFile(file);
    }
   }
```

Figure 5

(10 marks)

Question 6

(a) Sqlite is an *embedded database engine*. What does this term mean?

(2 marks)

(b) Figure 6 shows a subset of the data stored in the *tunes* table from an sqlite database file stored in a file called *tunes.sqlite*.

Table: tunes

	title	search_key
	Filter	Filter
1	Down the Hill	BAGEAAAAAEABCBABCABAGABGAGE...
2	Eagle's Whistle, The	GABBDBAGBBDBAGAAABAGAAABAGB...
3	Tabhair dom do l\'amh	DDEEGGGGGGGGDDEEGGGGGGGGDD...
4	An Rogaire Dubh	DDGGGABGAABBDDGGAABBDDDDGG...
5	Molly MacAlpin	ABCCAAAAGADCAGGGCDEEDEDCAAA...
6	Bluebell Polka, The	BDGBBBAGFGEDDDDBBBGFGABCCEE...
7	Merry Girl, The	DDBBBABBDDCCDCDDFEDCAGEFGGF...

Figure 6

Write code for a Java class called `Tune` that encapsulates one row of data from the file. In your solution include:

(i) Private fields to encapsulate the columns from the table.

(2 marks)

(ii) A `toString` method

(4 marks)

(iii) A setter for the `title` column.

(2 marks)

(iv) A constructor that takes an instance of a `ResultSet` object as a parameter.

(4 marks)

(c) Write Java code to connect to the database and populate an `ArrayList` of `Tune` objects with the results of a select query that selects all the rows from the database given in Figure 6.

(11 marks)