DEPARTMENT OF PHYSICS & ASTRONOMY
3459 EXAM-1
10:00 - 13:00 : November 16th 2011

Please read the exam guidelines, rules, instructions and marking criteria at `http://moodle.ucl.ac.uk/mod/wiki/view.php?id=13963&page=Mid-term+exam` (linked from the *Exams and coursework* page).

This exam is worth 25% of your final mark for the course and is made up of two parts:

- 15 multiple-choice questions, worth 7.5% of your final mark;
- a programming exercise, worth 17.5% of your final mark.

You should endeavour to spend no more than 30 minutes on the multiple-choice section.

Both the answers to the multiple-choice questions (in a file called `mc.txt`) and Java source code of your solution to the programming exercise should be uploaded using Moodle under the section headed “Exam 1”.

DEPARTMENT OF PHYSICS & ASTRONOMY
3459 EXAM-1
PROGRAMMING EXERCISE

You will write Java classes and methods to read data from a URL, analyse the data and present the results.

This year it felt like there were two overriding themes in London: the Olympics and the rain. The MET Office, the UK's National Weather Service, provides historical data on the average monthly rainfall in England and Wales from 1766 to the present day. This data is contained in a file at the following URL:

```
http://www.hep.ucl.ac.uk/undergrad/3459/exam-data/HadEWP_monthly_qc.txt
```

The format of the data in the file is documented at the start of the file.

You should write a program using appropriate classes and methods to read the data from the URL and store the rainfall data in suitable collection objects. Care should be taken to correctly ignore any invalid data (from, for example, future dates such as December 2012). You should:

- Determine the single wettest month ever recorded and print the year, the month and the recorded rainfall to the screen.
- For each month print to screen the wettest and driest years and the rainfall in those months.
- Determine the wettest three month period on record and print to screen when this period occurred and the total rainfall.
- Calculate and print the mean and RMS of the rainfall for each month.
- For each valid month of 2012 determine and print to the screen the percentage of previous years with a larger rainfall in that month.

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3459 EXAM-1
MULTIPLE CHOICE

You should endeavour to spend no more than 30 minutes on the multiple-choice section.

DO NOT WASTE TIME CODING THE QUESTIONS TO GET THE ANSWERS

You should enter your answers to the multiple-choice questions into a text file called `mc.txt` created using a text editor such as WordPad. The file should have the following format:

```
YOUR NAME
01 a
02 b
03 c
...
14 b
15 a
```

There is exactly one correct answer to each question.

Q1 What does `static` mean in the following code extract?

```
public class QuestionOne {
  public static int aNumber = 30;
    // ...
}
```

(a) There is a separate variable called `aNumber` belonging to each object of type `QuestionOne`.
(b) The value of the variable `aNumber` cannot be changed
(c) The value of the variable `aNumber` can only be changed by a method belonging to the class `QuestionOne`.
(d) There is only one variable called `aNumber` belonging to the class `QuestionOne`.

Q2 Why might this code not compile?

```
public class QuestionTwo {
  public void doSomething() { }
  public static void main(String[] args) {
    doSomething();
  }
}
```

(a) The `doSomething` method does not contain a `return` statement.
(b) The `main` method does not take the correct argument type.
`doSomething` without first creating an instance of `QuestionTwo`.
(c) It is valid code and will compile successfully.
(d) The `main` method is static and so cannot call the non-static method

Q3 How many lines of output will the following line print to the screen?

```
int a=0;
do {
  System.out.println("test"+a);
  a++;
}
while (a<5);
  System.out.println("Final a is "+a);
```

(a) 0
(b) 5
(c) 6
(d) 7

Q4 Which of the following methods will NOT compile when incorporated into a class?

(a) `private double funcD() {return 1.0;}`
(b) `public void funcB(int j) {}`
(c) `private static void funcC() {}`
(d) `private int funcA() {return 1.0;}`

Q5. What does the following line do?
`int a[] = new int[30];`

(a) It creates an array that can contain one integer, and assigns to this integer the value 30.
(b) It creates an array that can hold 30 integers, referred to as `a[0]` ... `a[29]`.
(c) It creates an array that can hold 31 integers, referred to as `a[0]` ... `a[30]`.
(d) It creates an array that can hold 30 integers, referred to as `a[1]` ... `a[[30]`.

Q6 What will be printed to the screen if the following code fragment is executed?

```
HashMap<Integer,String> data = new HashMap<Integer,String>();
data.put(1,"first");
data.put(2,"second");
System.out.println(data.get(1));
```

(a) `first`
(b) nothing since an error will occur when the code is compiled
(c) `1`
(d) `2`

Q7 What does `private` mean in the following code extract?

```
public class QuestionSeven {
  private double secret;
  public void setV(double d) {v = d;}
}
```

(a) The variable `secret` can only be accessed from the main program.
(b) The value of the variable `secret` cannot be changed once it has been set.
(c) The variable `secret` is stored in an encrypted form.
(d) The variable `secret` can only be accessed from the `QuestionSeven` class.

Q8 What number will be printed to the screen by the following program?

```
public class QuestionEight {
  private int nonStaticVar = 3;
  private static int staticVar = 5;
  public static void main(String[] args) {
    QuestionEight a = new QuestionEight();
    QuestionEight b = new QuestionEight();
    a.nonStaticVar = 6;
    a.staticVar = 2;
    b.staticVar = 4;
    System.out.println(a.nonStaticVar + a.staticVar);
  }
}
```

(a) `8`
(b) `10`
(c) `11`
(d) `35`

Q9. What will happen if you attempt to compile and run the following code fragment?

```
int anInt = Integer.parseInt("12.5");
System.out.println(anInt);
```

(a) A compilation error
(b) The program crashing and a `NumberFormatException` being thrown
(c) `12.5` being printed to the screen
(d) `12` being printed to the screen

Q10 Which of the following lines will successfully create a `Vector` object and add a `String` element?

(a) `Vector<String> v = {"two"};`
(b) `Vector<String> v = new String[3]; v.add("two");`
(c) `Vector<String> v = new Vector<String>(); v.add("2");`
(d) `Vector<String> v = new Vector<String>(); v.add(2);`

Q11. Which of the following would not be a valid line of code (i.e. would result in a compilation error) if inserted after the `"//here"` line?

```
public class QuestionEleven {
  public static void Tuesday() {System.out.println("Tuesday");}
  public void Thursday() {System.out.println("Thursday");}
  public static void main(String[] args) {
    QuestionEleven t = new QuestionEleven();
    // here
  }
}
```

(a) `Tuesday();`
(b) `Thursday();`
(c) `t.Thursday();`
(d) `QuestionEleven t2 = t;`

Q12 What type of object is created by this line of Java code?

```
HashMap<String,Character> h = new HashMap<String,Character>();
```

(a) An array that can hold a mixture of strings and character values.
(b) A map that can use character values as keys to access strings.
(c) A string of digits representing an ASCII character.
(d) A map that can use strings as keys to access character values.

Q13 How could you test the `QuestionThirteen` objects `a` and `b` in this program to verify that they contain the same value of `count`?

```
public class QuestionThirteen {
  private int count;
  public QuestionThirteen(int val) {count=val;}
  public static void main(String[] args) {
    QuestionThirteen a = new QuestionThirteen(6);
    QuestionThirteen b = new QuestionThirteen(7);
    // Test here!
  }
}
```

(a) Use the Java built-in `equals` method.
(b) Define your own `equals` method for the class.
(c) Use `if (a=b)` ...
(d) Use `if (a==b)` ...

Q14 What will be printed to the screen by the following code fragment?

```
int i=0;
Scanner s = new Scanner("exp(0) = 1");
while (s.hasNext()) {s.next(); i++;}
System.out.println(i);
```

(a) `1`
(b) `2`
(c) `3`
(d) `4`

Q15 Under what circumstance will the word “Finally!” be printed by the following program?

```
public class QuestionFifteen {
  public static void main(String[] args) {
    try {
      test();
    } catch (Exception e) {
      System.out.println("Exception!");
    } finally {
      System.out.println("Finally");
    }
  }
  public static void test() throws Exception {
    // ...
  }
}
```

(a) Only if the method `test` throws an exception.
(b) Never.
(c) Only if the method `test` does not throw an exception.
(d) Always.

END OF PAPER