Two hours

QUESTION PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Business Application Design & Development 2

Date: Monday 20th May 2013
Time: 09:45 - 11:45

Answer QUESTION ONE and TWO other Questions.

The total mark for the exam is out of 60.

Question 1 consists of 30 multiple choice questions worth a total of 30 marks. You should indicate clearly the number of your answer for each of these on the question paper.

Questions 2-5 are worth 15 marks each. You should answer these in the answer book provided

This is a CLOSED book examination

The use of electronic calculators is NOT permitted

[PTO]
Questions 1.1-1.30 are restricted and cannot be published
Question 2

This question is about **practical Java programming** using loops and arrays.

You are writing a class which contains information about events and the dates on which they occurred. Events are just Strings. Dates are objects of a class called Date, for which the following items are relevant:

The **Date** class has a method

```
public boolean moreRecentThan(Date other)
```
which returns true if the **Date** object the method is called on is more recent than the other **Date** object.
It also has a method

```
public boolean equals(Date other)
```
which is true if the dates are the same.
It has a constant **BEGINNING_OF_TIME** which is guaranteed to be older than any other **Date** objects.
It has a **toString()** method which returns a sensible String representation of a **Date**.

In your class you have an array of **Date** objects called **_dates** and an array of Strings called **_events**. Each element of **_dates** is the date of the corresponding element of **_events**, e.g. **_dates[3]** is the date of **_events[3]**.

2.1 [ Marks: 2 ]

How would you check whether the fifth date is more recent than the seventh, assuming that there are at least 7 dates?

2.2 [ Marks: 4 ]

Write a method

```
public Date mostRecent()
```
which returns the most recent date in the **_dates** array.

*Hint: the **BEGINNING_OF_TIME** constant and the **moreRecentThan()** method are useful here.*

2.3 [ Marks: 4 ]

Write a method

```
public String eventAt(Date date)
```
which returns the event at the given date, if any (you can assume there is not more than one). If there is no event at that date, it should return the String “No event at that date”.

*Hint: the **equals()** method is useful here.*

2.4 [ Marks: 5 ]

Write a method which prints the most recent event and its date on one line.
**Question 3**

This question is about **Inheritance**

3.1 [ Marks: 3 ]

Briefly explain, with an example, how inheritance in Java relates to the way we think about the world

3.2 [ Marks: 1 ]

What is the basic rule to apply when deciding whether inheritance is appropriate?

3.3 [ Marks: 2 ]

Give one example of inheritance which obeys the basic rule and one which does not. Use different examples from that in your answer to question 3.1.

3.4

3.4a [ Marks: 3 ]

Draw a UML diagram which shows an abstract **Bird** class with subclasses **Penguin**, **Sparrow** and **EddieTheEagle**

3.4b [ Marks: 3 ]

Show the Java class declarations corresponding to the diagram

3.4c [ Marks: 3 ]

Is the above example a good use of inheritance, a bad use, or a bit of both? Briefly explain why
Question 4

This question is about Collections

Note. The following description of the Date class is the same as in question 2.

You are writing a class which contains information about events and the dates on which they occurred.
Events are just Strings. Dates are objects of a class called Date, for which the following items are relevant:

That Date class is the same as in question 2, i.e. it has a method

```java
public boolean moreRecentThan(Date other)
which returns true if the Date object the method is called on is more recent than the other Date object
It also has a method public boolean equals(Date other) which is true if the dates are the same.
It has a constant BEGINNING_OF_TIME which is guaranteed to be older than any other Date objects.
It has a toString() method which returns a sensible String representation of a Date.
```

In your class you have two Lists, _dates and _events, where each element of _dates is the date of the corresponding element of _events, e.g. the third element of _dates is the date of the third element of _events.

4.1 [ Marks: 2 ]

How would you declare and initialise the list of dates, assuming that you are using ArrayLists

4.2 [ Marks: 2 ]

How would you check whether the fifth date is more recent than the seventh, assuming that there are at least 7 dates?

4.3 [ Marks: 4 ]

Write a method public String eventAt(Date date) which returns the event at the given date, if any (you can assume there is not more than one). If there is no event at that date, it should return the String “No event at that date”. Hint: the equals() method is useful here.

Question 4 continues on the next page
4.4

Suppose instead of ArrayLists you use a Map, _eventMap from dates to events.

4.4a [ Marks: 2 ]

Show how this Map would be declared and initialised

4.4b [ Marks: 2 ]

Show how the eventAt() method would be implemented using the Map

4.5 [ Marks: 3 ]

Briefly discuss the advantages of using a Map rather than a pair of ArrayLists or a pair of arrays. Are there any disadvantages?
Question 5

This question is about data storage

5.1 [ Marks: 3 ]

For three of the four forms of data storage introduced in the course, explain in one sentence how data is written out in that form from a Java program.

5.2 [ Marks: 3 ]

For the same three forms, explain in one sentence how stored data is read back into a Java program.

5.3 [ Marks: 1 ]

Which of the forms is not normally used for long-term data storage, and why?

5.4

The ABC exam software uses all four forms. While you are taking a test, backups of your work are sent to the server using Java serialization. These backups and exam and answer data generally are stored as XML files on the server. Information about which students are taking which courses etc. (hundreds of thousands of records) are stored in a relational database. Finally, marks are produced as CSV files.

5.4a [ Marks: 4 ]

For each of the formats, suggest one reason why we use it in the particular role (i.e. real time data backup, long term exam data storage, student data storage, result production) stated above.

5.4b [ Marks: 4 ]

For each role, suggest an alternative form of data storage we could have used, briefly explaining why.