UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

B. Sc. Examination 2005

COMPUTER SCIENCE

IS52013A (CIS219) Graphical Object-Oriented Programming and Website Design

Duration: 3 hours

Date and time:

This paper has two sections (A and B). You must answer TWO questions from section A and TWO questions from Section B. Each question is worth 25 marks. You must NOT attempt to answer more than two questions from each section.

THIS EXAMINATION PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

SECTION A

Question 1

a) "Design Patterns are generally not language specific." Discuss.

[2 Marks]

b) Explain each of:

i. Inheritance for extension.

[3 Marks]

ii. Inheritance for specialisation.

[3 Marks]

iii. Inheritance for specification (abstraction).

[3 Marks]

c) Demonstrate your understanding of the Observer - Observable design pattern by explaining the following terms in plain English:

i. Observer interface

[2 Marks]

ii. Observable class

[2 Marks]

iii. update method

[2 Marks]

iv. addObserver method

[2 Marks]

v. notifyObservers method

[2 Marks]

vi. setChanged, hasChanged and clearChanged method

[4 Marks]

Question 2

a) Consider the following three methods:

```
// The method min returns the smallest item in a given subarray
public static int min(int[] a, int lo, int hi){
    // REQUIRES:
    // EFFECTS:
    // MODIFIERS:
    int indx = lo;
    for (int i = lo+1; i <= hi; i++)
        if (a[i] < a[indx])
            indx = i;
    return indx;
}
// The method sort sorts an integer array in ascending order
public static void sort(int[] a){
    // REQUIRES:
    // EFFECTS:
    // MODIFIERS:
    for (int i = 0; i < a.length; i++){
        int indx = min(a, i, a.length-1);
        swap(a, i, indx);
    }
}
// the  method swap is swapping two items in an given array
public static void swap(int[] a, int i, int j){
    // REQUIRES:
    // EFFECTS:
    // MODIFIERS:
}
```

i. Write the REQUIRES, EFFECTS and MODIFIERS clauses for these methods

[9 Marks]

ii. Complete the swap procedure so that method sort sorts a given integer array in ascending order.

[6 Marks]

b) Program the recursive method called power.

```
public static int power(int a, int b)
  // Requires: b non-negative
  // Effects: Returns a raised to the power of b
```

[6 Marks]

c) Explain what it means when a method or a data field is "static" in java.
[4 Marks]

Question 3

a) Explain the use of Frameworks in Java, your answer should include at least one example:

[5 Marks]

b) Implement a class that has the following behaviour (you may solve all sub-questions within one class):

i. Program a small class displaying a rectangle in the center of a 400x400 JFrame.

[6 Marks]

ii. Change the size of the rectangle to 50x60 and fill it with the colour red.

[6 Marks]

iii. Add the following functionality:
When the mouse is moved within the rectangle's boundaries the color of the rectangle should change to green and when moved out again it should be changed back to red.

[8 Marks]

Section B
QUESTION 4

(a) State three advantages of using external Cascading Style Sheets (CSS) over placing style properties directly in the body of an XHTML document.

[6 Marks]

(b) For each of the following questions your answer may assume a CSS 2.0 compatible user agent.

(i) Briefly describe XPath and how it relates to CSS?

[2 Marks]

(ii) Write a style rule that changes the position of all headings to be 100 pixels from the left edge of their parent elements.

[2 Marks]

(iii) What is a style rule selector? What is a pseudoclass? Write a style rule to change hyperlinks to red when the mouse pointer is placed over them.

[3 Marks]

(c) Consider the following HTML document :-

```
<html>
  <head>
      <title>CIS219</title>
      <link type="text/css" href="style.css"/>
      <style type="text/css">
      a{font-family:sans-serif}
      </style>
  </head>
  <body>
     <a name="a"></a>
     <p>b</p>
     <div>c<span>d</span></div>
     <a href="#a"></a>
  </body>
</html>
```

Draw an XML document tree for this code.

[8 Marks]

(d) Consider the HTML document:-

```
1<!-- A non valid HTML document -->
2<html>
3  <head>
4    <title>Dr. Michael Casey</title>
5    <style>
6      body{font:arial;color:#3F8F2F;background-color:black}
7    </style>
8  </head>
9  <body>
10   <div style="alignment:absolute;left:100px;top:15px;width:250px;">
12     <h2>Dr. Michael Casey</h2>
13   </div>
14   <div style="position:absolute;left:450px;top:15px;width:500px;" align="left">
15     <h4>Senior Lecturer<br><a style="text-decoration:none" href="/">DoC</a></h4>
16   </div>
17   <div style="position:absolute;top:161px;left:0px">
18   <table>
19     <tr>
20     <td>
21       <a href="CIS336">CIS 219</a><br><br>
22       <a href="CIS336">CIS 221</a><br><br>
23       <a href="CIS336">CIS 336</a><br><br>
24     </td>
25     <td style="font-size:48">WWW students click here
26     </td>
27     </tr>
28   </table>
29   </div>
30 </body>
31<!-- end of document -->
```

There are 4 validation errors in this document. Write down the line number and a brief explaination of each error.

[4 Marks]

QUESTION 5

(a) University X has decided that all degree programmes are to be encoded in XML format. They have designed the following Document Type Definition for their programmes...

```
<!DOCTYPE programme [
    <!ELEMENT programme (year+)>
    <!ATTLIST programme name CDATA #REQUIRED version CDATA #IMPLIED>
    <!ELEMENT year (courseunit+)>
    <!ATTLIST year level CDATA #REQUIRED>
    <!ELEMENT courseunit EMPTY>
    <!ATTLIST courseunit courseID CDATA #IMPLIED name CDATA #REQUIRED>
]>
```

What is the meaning of the `(courseunit+)`expression?

[2 Marks]

(b) What is the meaning of `CDATA#IMPLIED` in the attribute lists of the DTD?

[3 Marks]

(c) The first year of University X's Supercomputing programme has the following structure...

courseID	name
IS11A	Programming Languages
IS12A	AI

Write a valid XML document that uses the DTD, defined above, to describe the first year of the *B.Sc. Supercomputing* programme.

[5 Marks]

(d) Write a new ATTLIST definition for the year ELEMENT that restricts values to numbers.

[2 Marks]

(e) Write a new courseunit ELEMENT definition to allow text descriptions to be added to each of the courses; e.g....

```
<courseunit name="Search Algorithms">
This course is about designing efficient algorithms for complex search tasks.
</courseunit>
```

[2 Marks]

(f) Write an XPath expressions that selects the following nodes in an XML document that uses the programme DTD from above:

(i) all the courseunits in the document.

(ii) All elements in year 2.

[5 Marks]

(g) University X now wants to modify their programme DTD so that each year ELEMENT is to contain new elements called "core" and "elective".

Each of these elements shall contain "courseunit" elements so that years are divided into core and elective blocks with courseunits nested inside these blocks.

All years shall contain at least one core courseunit, but not all years need to contain electives.

Write a new DTD that defines this new programme structure.

[6 Marks]

QUESTION 6

(a) Assume that the following script is accessible via the URL

`http://shop.com/shop.php`

What does the function call on line 02 do when this page is first requested by a web browser?

```
01 <?php
02 session_start();
03 ?>
04 <html>
05 <body>
06 <?php
07 switch ($_GET['action']){
08  case 'add':
09    $_SESSION['basket'][$_GET['product']]++;
10    $_SESSION['items']++;
11    break;
12  case 'pay':
13    echo 'Thank you for your payment.<br><br>';
14    session_unset();
15 }
16 if($_SESSION['items']>0){
17   echo 'Shopping Cart:<br><br>';
18   $basketArr = array_keys($_SESSION['basket']);
19   foreach ($basketArr as $product){
20     echo 'product: ' . $product . ' qty: ' . $_SESSION['basket'][$product] . '<br>';
21   }
22   echo '<b>The current total is ' . $_SESSION['items'] . ' pounds.</b>';
23   echo '<br><br>';
24 }
25 echo 'Shop Inventory:<br><br>';
26 echo '<a href="shop.php?action=add&product=Apple">Apple</a> 1 pound<br>';
27 echo '<a href="shop.php?action=add&product=Orange">Orange</a> 1 pound<br>';
28 echo '<a href="shop.php?action=add&product=Banana">Banana</a> 1 pound<br>';
29 echo '<br>';
30 echo '<a href="shop.php?action=pay">Pay</a><br>';
31 ?>
32 </body>
33 </html>
```

[2 Marks]

(b) What does the `session_start()` function call do on line 02 when the page is subsequently requested by the same web browser?

[2 Marks]

(c) What does the `session_unset()` function call do on line 14? Write a URL that results in a call to line 14 of the script.

[2 Marks]

(d) Write down what is displayed in a web browser upon requesting the URL `http://shop.com/shop.php` for the first time. Underline all hyperlinks.

[4 Marks]

(e) Write down what is displayed in the web browser upon clicking the first hyperlink twice.

[5 Marks]

(f) What is the purpose of the `$_GET['product']` expression on line 09? Write a new `case` statement, see lines 07-15, that removes one item from the shopping cart. The name of the product to be removed is available in an array. You should guard against negative quantities in your answer.

[5 Marks]

(g) Rewrite line 20 so that a user may click on a product name to remove one item of that product type from the cart. Hint: the code from this modification should activate the `case statement` from your previous answer.

[5 Marks]