NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCE
COMPUTER SCIENCE DEPARTMENT
JULY SUPPLEMENTARY EXAMINATIONS 2005

SUBJECT: OBJECT ORIENTED PROGRAMMING I
CODE: SCS5101

INSTRUCTION TO CANDIDATES

Include UML class diagrams in your responses
Answer 5 questions

Time: 3 hours

QUESTION ONE

Write a program that accepts as inputs the coefficients associated with a quadratic equation. The program should produce as outputs, the roots of the quadratic equation. The quadratic equation is generally expressed in the following form

$ax^2 + bx + c = 0$. The solutions are generally expressed as $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. Your program should show all possible solutions, including complex solutions.

[20]

QUESTION TWO

(a) Write a program that accepts an . . . as input and produces as output patterns of the following type. Only two examples are given here.

```
For input = 5        For input = 3
    *                    *
   ***                  ***
  *****                  *
   ***
    *
```

QUESTION THREE

Write a Java program that accepts up to 100 numbers as input. This program should calculate the following quantities as outputs:

(a) The sum of all the numbers x_i: i.e. $\sum_{i=1}^{n} x_i$, where n is a count of the numbers entered into the program.

[4]

(c) The standard deviation $\sigma = \sqrt{\dfrac{\sum_{i=1}^{n}(x - x_i)^2}{n-1}}$.

[8]

Use a separate method for each calculation.

QUESTION FOUR

Define the following terms
(a) class   [2]
(b) object   [2]
(c) signature   [2]
(d) state   [2]
(e) constructor   [2]
(f) accessor   [2]
(g) mutator   [2]
(h) parameter   [2]
(i) operator   [2]
(j) declaration   [2]

QUESTION FIVE

Write a program based on the Swing set of classes. This program should display a digital clock as its output. When the clock is instantiated it should indicate the time as 00:00. Include four buttons on the user interface. One to increment the time by 1 minute, the other to decrement the time by 1 minute. One to increment the time by 1 hour, and one to decrement the time by 1 hour. The time displayed should change in accordance with the buttons pressed and should always indicate a valid 24 four hour clock time.

[20]

2

QUESTION SIX

(a) What is the difference between an interface and an abstract class? Use code examples to illustrate the difference.

[10]

(b) What is the meaning of the term polymorphism. Use a suitable coded example to demonstrate your understanding of this concept.

[10]

QUESTION SEVEN

(a) What is the difference between instance variables and class variables? Show the different ways that these variables are declared.

[5]

(b) What is the difference between a static inner class and a non-static inner class?

[4]

(c) Explain the meaning of the term final when it is applied to a class.

[2]

(d) Explain the meaning of the term final when it is applied to class variable.

[2]

(e) Write a simple program based on a JFrame that illustrates how to associate a programmed action with the click of a JButton.

[7]

END OF QUESTION PAPER