

University of Swaziland  
Department Of Computer Science  
Supplementary Examination  
July 2011

**Title of paper:** *C under Unix*

**Course number:** *CS344*

**Time Allowed:** *Three (3) hours*

**Instructions:**

- *Each question is worth 20 marks*
- *Answer any five (5) questions from questions 1 to 7*

*This paper may not be opened until permission has been granted by the invigilator*

**Question 1**

- (i) Explain the meaning of the following object-oriented terms
- (a) Encapsulation. *2 marks*
  - (b) Class. *2 marks*
  - (c) Inheritance. *2 marks*
  - (d) Polymorphism. *2 marks*
  - (e) Message Passing. *2 marks*
- (ii) Explain the main difference between the following terms.
- (a) Overloading and Overriding. *2 marks*
  - (b) Operation polymorphism and Inclusion polymorphism. *2 marks*
  - (c) Private base class and Public base class. *2 marks*
  - (d) Private and Protected members. *2 marks*
  - (e) Accessor and Implementor member functions. *2 marks*

**Question 2**

- (i) What is a class template? *2 marks*
- (ii) What are the advantages of using class templates? *3 marks*
- (iii) Using a template, write a C++ stack class definition. You may assume an array implementation of the stack. *5 marks*
- (iv) Using your class definition in (ii) above, write the suitable function definitions for the member functions. *Stack, Push, Pop* and *IsEmpty* operation. *8 marks*.
- (v) Show how your stack class definition may be used to declare a stack of integer numbers or real numbers or characters. *2 marks*

**Question 3**

- (i) What is a virtual member function. 3 marks
- (ii) What is an abstract class. 2 marks.
- (iii) Using virtual member functions where appropriate, Design a C++ class hierarchy for shapes. A shape could be a rectangle, a circle, a triangle. A Triangle could be equilateral or right-angled. For each shape, the area and perimeter may be computed. Each area may be filled with a set of tiles, which cost a fixed amount per square unit of the area being filled. The total cost for tiling each shape may also be computed. The perimeter of each shape may also be fenced using fencing wire that costs a fixed amount per unit length. The total fencing cost may also be computed. 15 marks

**Question 4**

- (i) What is a function template. 3 marks.
- (ii) Explain the advantages of using function templates. 4 marks
- (iii) What is the standard template library (STL). 4 marks
- (iv) Write a function template for a **Max** function that takes two data values as arguments and returns the largest value. 5 marks
- (v) Show how your function definition may be used to compare integer or character values. 4 marks

**Question 5**

- (i) What is a friend function/operator. 3 marks
- (ii) What are the advantages of a friend function/operator over an ordinary member function/operator. 2 marks.
- (iii) Using friends where appropriate, write a class definition for complex numbers, assuming the following operations may be performed on complex numbers.
- Re()* - returns real-part of complex number Z.
  - Im()* - returns imaginary-part of complex number Z.
  - +* - adds two complex numbers Z1 and Z2.
  - \** - multiplies two complex numbers Z1 and Z2.
  - <<* - prints a complex number Z to output stream, say OutFile.

15 marks

**Question 6**

The fibonacci function is defined as follows:

$$\begin{aligned} \text{Fibonacci}(n) &= 1; && \text{if } n = 1 \text{ or } n = 2; \\ &= \text{Fibonacci}(n-1) + \text{Fibonacci}(n-2) && \text{if } n \geq 3; \end{aligned}$$

- (a) Using C++, write an iterative definition of the fibonacci function. *10 marks*  
 (b) Using C++, write a recursive definition of the fibonacci function. *10 marks*

**Question 7**

Using C++ notation,

- (i) Write a suitable type declaration that may be used to declare any array variable of 10 real numbers. *2 marks*
- (ii) Using your type declaration above, how can you declare variable A as an array variable of ten (10) real numbers. *2 marks*
- (iii) Write a function, *init* that takes an array of 10 real numbers as its argument and initializes all the elements of the array to 0. *4 marks*
- (iv) Write a function, *showall*, that takes an array of 10 real numbers as its argument, and prints all the values of the array on standard output. *4 marks*
- (v) Write a function, *Double*, that takes an array variable of 10 real numbers as its argument, and multiplies each array element by 2. *4 marks*
- (vi) Write a function, *add*, that takes two (2) arrays of 10 real numbers as its arguments, and then add the values of the two arrays and stores the results in another array C. Finally, the function must call function *showall*, to display the result of the addition on standard output.. *4 marks*