# University of Swaziland
## Department Of Computer Science
### Main Examination
### December 2011

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

**Course number:**          *CS344*

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

**Instructions:**

- *Each question is worth 25 marks*
- *Answer question 1*
- *Answer any three (3) questions from questions 2 to 6*

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

# Question 1-25 marks
## (Compulsory)

Consider the following description of a company payroll structure.

*A company pays its employees weekly. Each employee has a PIN number, Firstname and Surname. The Employees are of three types: Salaried employees are paid a fixed weekly salary regardless of the number of hours worked. Hourly employees are paid by the hour and receive overtime pay (calculated a double the normal rate) for all hours worked in excess of 40 hours. Commission employees receive a base salary plus a 10% of their total weekly sales.*

    (a) Using UML notation, draw a class diagram showing the hierarchical payroll structure.        *10 Marks*

    (b) Using C++ notation, define the class hierarchy obtained in part (a) above. Your definition must include an overloaded insertion operator that displays relevant attributes of each class. All other relevant member functions must also be defined.        *15 Marks*


# Question 2-25 marks

(i)     With the aid of examples, Explain the meaning of the following terms.

        (a) function template                       *2 Marks*
        (b) Function prototype                        *2 Marks*
        (c) Virtual function                           *2 Marks*
        (d) Polymorphism                            *2 Marks*
        (e) Encapsulation                            *2 Marks*

(ii)    Write a C++ program that performs the following:

       • declares a 5×5 array of integer values         *2 Marks*
       • display the sum of each row             *5 Marks*
       • display the sum of each column        *5 Marks*
       • the highest row sum                 *3 Marks*

# Question 3- 25 marks

(i) Distinguish between the following

    a. C and C++                                                  *2 marks*

    b. A class and structure                                  *2 marks*

    c. #include and #define                                 *2 marks*

    d. An object and a class                                  *2 marks*

    e. Composition and aggregation                        *2 marks*

(ii) An integer is said to be a prime number if it is only divisible by one and itself. For example 7 is a prime. Write a function **isPrime (n)** that determines whether parameter number n is a prime number. Use the function to write a program that displays, on standard output, all the prime number less than 100.

*15 marks*

# Question 4 – 25 marks

(i) Write the C++ syntax and draw the activity diagram for the following statements.

    (a) **Switch** statement                                     *4 marks*

    (b) **for** statement.                                            *4 marks*

(ii) Write a C++ program that prompt the user to enter an amount in Emalangeni, and computes the number of E200, E100, E50, E20, E10 notes, and E1 coins. The goal is to have as many E200 notes a possible, then E100 note, etc. The output should be in the following format:

```
Input amount :   E797

Number E200 notes  =  3
Number E100 notes  =  1
Number E50 notes    =  1
Number E20 notes    =  2
Number E10 notes    =  0
Number E1 coins      =  7
```

*17 marks*

# Question 5 – 25 marks

(i)    Consider the sequence defined by :

$$\text{Seq (n)} \quad \begin{array}{ll} = 1 & \text{if } n = 0 \\ = 0 & \text{if } n = 1 \\ = \text{Seq (n-2)} & \text{if } n >= 2 \end{array}$$

        (a) Write a non-recursive function that takes an integer value n as an argument and computes and returns the **Seq (n)**.

*8 marks*

        (b) Write a recursive function that takes an integer value n as an argument and computes and returns the **Seq (n)**.

*5 marks*

(ii)    Write a C++ program that takes two text files, **InFile** and **OutFile**, as input. The program copies and double spaces (adds a blank line in between) the contents of InFile to OutFile.    *12 marks*

# Question 6 – 25 marks

(i)    Briefly describe the five (5) basic concepts of object-oriented programming?

*10 marks*

(ii)    Explain how each of the concepts described in (i) above is implemented in C++?

*15 marks*