University of Swaziland
Department Of Computer Science
Supplementary Examination
JULY 2012

Title of paper: *C under Unix*

Course number: *CS344*

Time Allowed: *Three (3) hours*

Instructions:

- *Answer question 1.*
- *Answer any other three (3) questions from questions 2 to 6*
- *Each question carries 25 marks*

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

Question 1-25 marks (Compulsory)

Using UML notation, draw a class diagram for the VIP cosmetics company described below. Your diagram must show suitable classes, association and processing dependencies, and accessibility of class members.

VIP cosmetics

VIP cosmetics is a successful network sales company. The company sells a variety of health and beauty products through selected distributors. A distributor is a person who has committed himself to selling the products of the company. The distributors then sell to the general public. VIP keeps a list of all its distributors. This list details the distributor name, postal address and other essential details.

Distributors buy products by placing orders with VIP head office. The order contains a list of items that the distributor wants to buy. This list details the product identity code and the quantity being ordered. The total cost for each order item may also be computed by multiplying the quantity by the product price. The product price may be obtained from a list of all the products. This list details the product code, name, description and price. The total cost of each order may be computed by summing the cost of each item on the order.

Distributors receive a discount depending on how many points they have accumulated since joining VIP as a distributor. The number of points is proportional to the accumulated total cost of their orders. For example, if they place an order costing E200 they receive an extra 200 points. Distributors who have just joined VIP receive 30% discount. Distributors who have accumulated 2 500 points receive 35% discount, 10 000 points receive 40% discount, 20 000 points receive 44% discount, 40 000 points receive 48% discount and 80 000 points receives 52% discount.

Question 2-25 marks

Using C++ notation, write class definitions for all the classes identified in question one (1) above. (Do not write any definitions for the member functions)

Question 3 – 25 marks

Rewrite the following C++ program using class and objects (instead of struct and variables).

```cpp
#include <iostream>
const N = 9;

struct List
{int Item[N+1];
 int Size;
};
void Init (List& );
bool IsEmpty (List);
bool IsMember (int, List);
void Insert (int, List&);
ostream& operator<< (ostream&, List);

void main ()
{List L;
 Init (L);
 Insert (3, L); Insert (9, L); Insert (4, L);
 Insert (4, L);Insert (2, L);
 cout << L;
}

void Init (List& L)
{for (int i =0; i <= N; i++)
      L.Item[i] = 0;
 L.Size = 0;
}

bool IsEmpty ( List L) { return (L.Size == 0); }

bool IsMember (int e,  List L)
{ if ( IsEmpty(L) || ( e > N) || (e < 0))
    return false;
  else
    return (L.Item[e] > 0);
}

void Insert (int e, List& L)
{if ( (e <= N) && (e >= 0) )
   L.Item[e]++;
 L.Size++;
}

ostream& operator<< (ostream& os , List L)
 {
 for (int i =0; i <= N ; i++)
    for (int j = 1; j <= L.Item[i]; j++)
       os << i << "  ";
 os << endl;
}
```

3

Question 4 – 25 marks

(i) Distinguish between single inheritance and multiple inheritance. *2 marks*

(ii) Using the concepts of classes, subclasses and inheritance, model (use class diagram) an account class hierarchy for a banking enterprise. For each account, the account number, name of holder (owner) and balance are recorded. Account holders may deposit or withdraw money from the account. A deposit transaction increments the balance by the amount being deposited and a withdrawal decrements the balance by the amount being withdrawn. The enterprise has two types of accounts: A current (cheque) account and a savings account. For each current account the overdraft limit is recorded. The overdraft limit is the amount by which the account holder is allowed to overspend each month. The overdraft limit may be changed from time to time. Each savings account attracts an annual interest rate. This rate may be changed from time to time. The interest for each savings account is calculated each month and deposited into the account. The following formula may be used for this purpose: MonthlyInterest = Annualrate * balance / 12. The details for each account may be printed when necessary. For a current account the account number, name of owner, balance and overdraft limit may be printed. For a savings account the account number, name of owner, balance and interest rate are printed.

10 marks

(iii) Using C++ notation write an implementation of the class hierarchy obtained 4(ii) above. Your program should define all the classes and also write the corresponding code for the member functions in each class.

15 marks

Question 5– 25 marks

(i) Using templates, write a function that returns the smallest of three argument values. *7 marks*

(ii) Show how the functions could be used with integer or char or float arguments. *3 marks*

(iii) An integer is said to be perfect if the sum of its factors, including 1(but not the number itself), is equal to the number. For example, 6 is a perfect number because 6 = 1+ 2+ 3. Write a function **perfect** that determines whether parameter **number** is a perfect number. Use this function in a program that determines and prints all perfect numbers between 1 and 1000.

15 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 (b) above is implemented in C++?

10 marks

(iii)   Explain the following concepts, giving examples where possible?

(a) Function Prototype	*1 mark*
(b) Function Signature	*1 mark*
(c) Function Overloading	*1 mark*
(d) Friend function	*1 mark*
(e) Constructor	*1 mark*