

**University of Swaziland**  
**Department of Computer Science**  
**Supplementary Examination 2006/2007**

*Title of paper : Software Engineering II*

*Course number : CS452*

*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*

**Questions 1 and 2 is based on the following case study.**

**Manzini Sound and Video (MS&V) Store.**

Samuel (Sam) Thwala is the owner of Manzini Sound and Video (MS&V) store, a small mail-order store that features video and audiocassette tapes. The store is located on Martin Street in Manzini and operates from 8a.m to 6p.m daily. He keeps an inventory of all the 100 most popular video and audio titles in his shop, he orders other titles from four South African distributors he deals with. Others that cannot be filled from these sources are returned to customers marked "unavailable item".

All of Sam's business is mail order. He publishes a flier of 200 titles four times a year, based on current best-selling titles reported in trade publications. In addition, he sometimes runs spot ads in the Sunday times newspapers.

When an order is received, the payment is verified before the order is filled. If payment is a cheque, Sam holds the order for fourteen days or until the cheque has been cleared by the bank. Sam deposits cheques and money orders every other day with his bank. He also accepts cash cards and credit cards such as Master cards, Visa and American Express. In order to verify whether accounts are good, he looks at weekly listing of bad account holders, as provided by credit card companies. However, on a number of occasions, he has accepted a "bad" credit card or a card being used by an unauthorized user because the information in his weekly listing was not 100% up-to-date.

Daily orders are separated into two categories: In-stock orders and special orders. In-stock orders are filled and shipped to customers on daily basis. A photocopy of the order form serves as a packing slip. If the item is for a special order, the special order file is updated and the customer's order is placed in a pending file.

Every Monday, Sam retrieves his special orders from the file and places his weekly purchase orders to obtain sufficient inventory of these titles. He also takes this opportunity to replenish his in-house inventory. He very often reviews the 100 titles he regularly carries in stock, adding new ones and eliminating slow sellers.

Sam places his orders for inventory over the phone and by fax, sends each vendor a follow-up purchase order. For each purchase order faxed, he files a copy in his placed-orders file. When he receives these items, he fills the outstanding orders as well as the special orders. After an order has been filled, he transfers the orders form to an orders-filled file.

When an order is filled, the customer's name and address are checked against a customer card file that is used for quarterly mailings. If the customer's address has changed, the customer's card file is updated.

At the end of each month, Sam processes his accounts payable. He tries to take advantage of vendor discounts by paying bills within discount periods. At the beginning of the second week of each month, Sam's accountant comes in, collects the previous months records and provides Sam with a monthly activity report summarizing his profits and loses. At this time Sam reviews his inventory, adjusts his titles and updates his flier for mailing purposes.

### Question 1 – 25 marks

Using UML notation, draw a USE CASE diagram for of Manzini Sound and Video (MS&V) store 25 marks

### Question 2- 25 Marks

(a) Without assuming any particular implementation, draw a sequence diagram for the scenario described in paragraph 6 of the Manzini Sound and Video (MS&V) store.

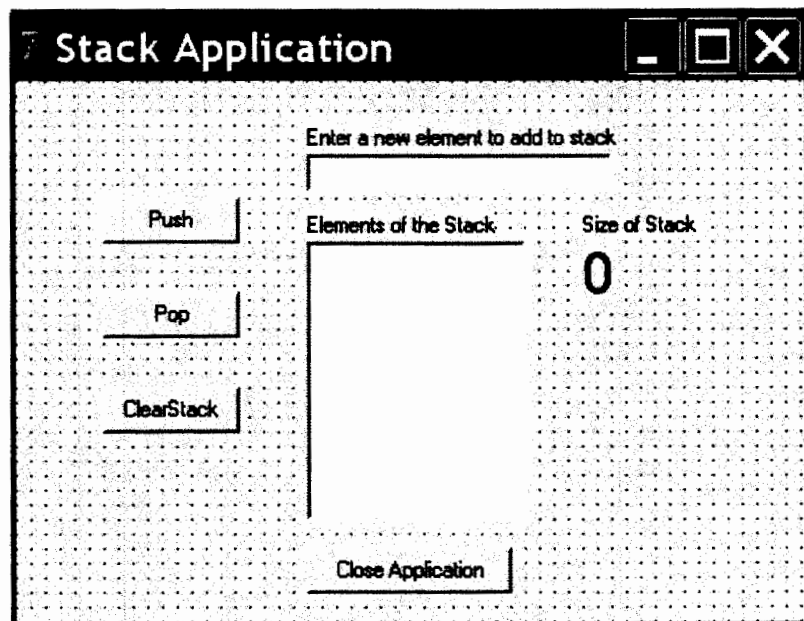
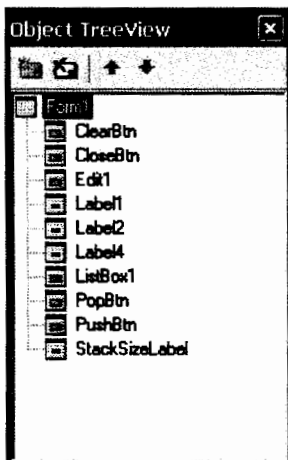
*15 marks*

(b) Assuming a windows implementation, re-draw the sequence diagram obtained above.

*10 marks*

### Question 3 – 25 Marks

(a) Consider the following Delphi user interface. The Object TreeView for the project is as shown on the left. Using UML notation draw a HIC class diagram for this user interface. *15 Marks*



- (b) The problem domain component (PDC) for the Stack Application project contains the following **TStack** class definition.

```
const MaxSize = 15;
Type DataType = string;
Tstack = class(TObject)
private
    Size : 0..MaxSize;
    Item : Array[1..MaxSize] of DataType;
    function IsEmpty : Boolean;
    function IsFull : Boolean;
public
    procedure Push (NewElement : DataType);
    procedure Pop;
    function Top :DataType;
end;
```

- (i) Draw a PDC class diagram for the Stack Application. *7 Marks*
- (ii) Show (if any) processing dependencies between the HIC obtained in (a) above and the PDC. *3 Marks*

#### **Question 4 - 25 Marks**

- (a) Explain the notions of cohesion and coupling. Discuss the different forms of coupling and rank them in terms of their desirability. *12 marks*
- (b) What is the essence of information hiding. *3 marks*
- (c) Explain how coupling, cohesion and information hiding are inter-related design principles. *3 marks*
- (d) Explain how object-oriented design enforces the following qualities of a good design: Information hiding, Weak coupling and High cohesion. *7 marks*

#### **Question 5 – 25 Marks**

- a) Discuss the main advantages of Object-Oriented software development methods versus traditional structured methods *7 marks*
- b) Discuss the contribution of Object-Oriented software development in the following aspects of software development.
- (i) Managing the software development process. *6 marks*
- (ii) Prototyping. *6 marks*
- (iii) Improving the maintainability of a software system. *6 marks*

### Question 6 – 25 Marks

- (a) Describe the following categories of test technique
- (i) Coverage-based testing *3 Marks*
  - (ii) Fault-based testing *3 Marks*
  - (iii) Error-based testing. *3 Marks*
- (b) What is the difference between black box testing and white box testing? *3 Marks*
- (c) What is a test adequacy criterion? *3 Marks*
- (d) Consider the following routine

```
Procedure Shiftdown (var A:Array of integer; k,n:integer);
Var parent, child, insert, Ak : integer;
begin
  Parent := k; child := k+k;
  Ak := A[k]; insert := Ak;
loop
  if child > n then exit end;
  if child < n then
    if A[child] > A[child+1] then child := child + 1 end
  end;
  if Insert <= A[child]
    then exit
    else A[parent] := A[child];
          Parent := child; child := child+child
    end
  end;
  A[parent] := Ak
end;
```

Assume the routine is tested using the following input:

N=5, k=2

A[1] = 80, A[2] = 60, A[3] = 90, A[4] = 70, A[5] = 10

Determine if the above test will yield a 100% statement coverage. If not, provide one or more additional test cases that a 100% coverage is obtained from. *10 Marks*