VICTORIA UNIVERSITY
Kampala · Uganda

"Come Prepared to Learn, Leave Prepared to Succeed"

EXAMINATION

FACULTY OF SCIENCE AND TECHNOLOGY

PROGRAMME(S): BSF, BSC, BSF, BBC, DIT

SESSION: DAY/EVENING/WEEKEND

MODULE CODE AND TITLE:	**LEVEL:**
1301 ST, 1204 ST, 1303 – Object Oriented Programming	1.1
DATE: January, 2025	**TIME:**
DURATION: 6 HOURS	**TOTAL MARKS:** 100
EXAMINER/ LECTURER: Mr. Bazigu Alex	**MODERATOR:** Dr. David Kakeeto

INSTRUCTIONS TO THE CANDIDATE/ STUDENT

1. V-class is the **ONLY** official examination platform.
2. Questions must be attempted in the answer booklet/sheet provided on V-class.
3. All queries should be directed to the examiner, Head of Department, or Dean.
4. You have **SIX HOURS** to complete this paper. No exam answer sheet shall be accepted after the 6 hours (the system has closed).
5. This is an **OPEN BOOK (Online)** examination.
6. Attempt 4 Questions in total. All questions carry equal marks (25 marks each).
7. All questions are C**OMPULSORY**
8. Read each question carefully before beginning to type/write your answers.
9. Review the grades assigned to each question of the examination and allocate your time accordingly.
10. Review your answers carefully before submitting your examination**.**
11. After submitting your exam answer sheet, Cross-Check to ensure your examination was attached and sent to V-class and received a confirmation message.

Section A
Answer All Questions

Library Management System for Victoria University

Victoria University is operating Two libraries, one at the Victoria towers while another one is at Market Plaza Building Level 9. The University seeks to modernize its library management system to provide efficient cataloging and accessibility for books.

The university's library maintains thousands of books, each uniquely identified by an International Standard Book Number (ISBN). To improve organization and retrieval, the system will incorporate object-oriented programming principles to model the details of books and their ISBNs.

The ISBN is a globally recognized identifier for books, consisting of 10 digits divided into four parts, each providing specific information about the book:

- The ISBN consists of 10 digits divided into 4 parts. For example, the ISBN 0 941831 39 6 represents the following information:
- The first part: The first digit "0" signifies the book is from an English-speaking country.
- The second part: "941831" identifies the publisher.
- The third part: "39" is the title number for the book.
- The fourth part: "6" is a check digit to indicate that the sum of the ISBN digits is 10.

You will be required to design a class called ISBN to represent an International Standard Book Number, or ISBN for short. The class should have a constructor and methods to set and get the ISBN as a string.

Q1

Design a Book class that represents relevant information about a book, including the book's title, author, publisher, city and date of publication, and price. The class should also include the field ISBN isbnNum; where ISBN is the class defined above.

This class should include a constructor and the following methods:

- setBookISBN: to set the ISBN for the book.
- getAuthor: to return the author of the book.
- getBookISBN: to get the ISBN of the book.
- printDetails: to print the information of a book in the following form:

Book Title: Object-oriented Programming with Java

Book Author: David j. Barnes and Michael Kolling

Publisher: Prentice Hall

ISBN: 0 941831 39 6 (15 marks)

b) Discuss the following citing examples from the Library Management System for Victoria University

i) Class Constructor (2 marks)

ii) Object Instantiation (2 marks)

iii) Object Invocation (2 marks)

iv) Method overlapping (2 marks)

v) Method Overloading (2 marks)

(Total 25 marks)

Q.2.

a) Distinguish between the following terms with examples/ illustrations as used in object-oriented programming

(i) Base class and derived class (2 marks)

(ii) Global scope and local scope (2 marks)

(iii) Source code and object code (2 marks)

(iv) While loop and do while loop (2 marks)

b) In an Online Assessment, A given student is given grade 'A' to 'E' in an exam. So average of six units can be calculated, it is required to assign marks to these grades as follows

'A' is greater than and equal to 70

'B' is between 69 and 60

'C' is between 59 and 50

'D' is between 49 and 40

'E' is below 40

Write appropriate Java statements for the program that allows input of six units, calculate average and output appropriate grade. (10 Marks)

c) Write a Java program that implements a class named Odd with a data member named x and method named read that accepts an integer from the keyboard. The program determines whether the integer is odd or even and displays an appropriate message. Use the if statement. (7 marks)

(Total 25 marks)

Section B

Answer any two questions

Q.3.

a) Victoria University established the Mathematics club to keep students in the Faculty Education, in the Mathematics departments. The head of the clubs has highlighted the need for the program which will read the length and width of a rectangle as input from the user which will output the area and the length and perimeter of a rectangle. Write a program for this problem. (6 marks)

b) Differentiate the following terms and demonstrate how their syntax implementation

i) Constructor and destructors (4 marks)

ii) Implicit and explicit conversion (4 marks)

c) Discuss the 3 types of Errors in Object-oriented Programming with scenarios and examples. (6 marks)

d) Identify the errors in the following piece of code extracted from an example in class.(5 Marks)

(i)

```
import java.util.*;
class C {
      public Stack m(int x){
            Stack s = new Stack();
            s.push((Integer)x);
            return s;
      }
}
```

(ii)

```
class J extends SuperJ {
    public J(){
                    System.out.println("ConsJ");
    }
    public void m(){
                      System.out.println("J");
    }

    public static void main(String[] args){
                         SuperJ o = new J();
                                o.m();
    }
}

class SuperJ {
    public SuperJ(){
                   System.out.println("ConsSuperJ");
    }

    public void m(){
                    System.out.println("SuperJ");
    }
}
```

(Total 25 marks)

Q.4.

A Company produces a set of Mobile Phones and Television Sets. The Mobile Phones are named "A10", "X25" and "TPlus", the TV sets are named as "Alpha 40", "Gamma 50" and "Theta 65". Use the AbstractFactory Design patterns to create these objects.

a. Create a Mobile Phone hierarchy, the MobilePhone abstract class should contain the Model and Price.
   i) Include an abstract method called Display().
   ii) Create sub classes A10, X25 and TPlus that extend the MobilePhone Hierachy
   iii) Override the Display method to display the details of the phone in each of the sub classes. (7 Marks)

b. Create a TV hierarchy, the TV abstract class should contain the Model and the size.
   i) Include an abstract method called Display()
   ii) Create sub classes Alpha40, Gamma50 and Theta65 that extend the TV Hierachy
   iii) Override the Display method to display the details of the phone in each of the sub classes. (8 marks)

c. Create the AbstractFactory class and the subclasses TVFactory and MobileFactory according to the AbstractFactory design pattern. (4 marks)

d. In the FactoryDemo class main() function
   i) Input the Model of a Phone and a TV
   ii) Get an object of the TV and MobilePhone created using the AbsractFactory Design Pattern. (6 marks)

e. Save the program as Ques2b.java and upload the code to GitHub and in the Answer Booklet provide only the GitHub Link for your Source code .

(Total 25 marks)

Q.5.

a) c) Citing relevant examples, differentiate between the Single Dimensional and Mult-Dimensional Arrays (6 marks)

b) A retail store uses a Java-based system to manage inventory and sales. Arrays are employed to store and process product and sales data. The store sells five products, each identified by a unique product ID. Prices for these products are stored in an array.
   (i) Write a Java program to declare and initialize the array, and then print the price of each product. (5 Marks)
   (ii) Each product's daily sales are recorded in an array for 7 days (one week). Using a 2D array, write a Java program to calculate the total weekly sales for each product. (5 Marks)

c) You are provided with the following code;-

```
public static void fact(int z){
        try {
                fact2(z);
                System.out.println(15);
        } catch (ArithmeticException e) {
                System.out.println(20);
        } catch (Exception e) {
                System.out.println(25);
        }
}
public static void fact2(int z) throws IOException {
        System.out.println(30);
        if (z==1)
                throw new IOException();
        if (z==0)
                throw new ArithmeticException();
        System.out.println(35);
}
```

(i) Re-write the program with comments to ease one's understanding.

(ii) Write what is printed to the console by fact(1) and fact(2) (5 marks)

d) Below is a program that demonstrates the use of an array. Explain its functionality.

```
public class MarksArray {

    public static void main(String[] args) {
        int [] marks = {16, 22, 77, 40, 75};

        for (int i = 0; i < marks.length; i++){
            System.out.println(marks[i] + " ");
        }

        int total = 0;
        for (int i = 0; i < marks.length; i++){
            total += marks[i];
        }

        System.out.println("Total is " + total);

        int max = marks[0];
        for (int i = 0; i < marks.length; i++){
            if (marks[i] > max) max = marks[i] ;
        }
        System.out.println("Max is " + max);

    }
}
```

Provide a simple code example to demonstrate how an array can be passed as a parameter to a method in Java.

(Total 25 marks)

Q.6.

a) Define the following main features and concepts as used in object-oriented programming

(i) Objects (2 marks)

(ii) Classes (2 marks)

(iii) Data obstruction (2 marks)

(iv) Encapsulation (2 marks)

(v) Inheritance (2 marks)

b) Define a class student with the following specification

Adm_no integer, Sname 20 characters, float (marks in three subjects OOP,

CALCULUS, SAD) and Total float

calctotal() – function to calculate marks

Public member function of class student

getdata() – function to accept values Adm_no, Sname, marks in OOP,

CALCULUS, SAD and invoke calctotal() to calculate total

displaydata() – function to display all data members on the screen (10 Marks)

c) In a given Java program with a main() method and a convert() method, x is a local variable in main(), visible only within main() and lasting for its execution. In convert(), y is a local variable with visibility and lifetime limited to the method, while z is declared as static, making it shared across all instances and persisting for the program's lifetime. A static variable m is declared at the class level, accessible to all methods and retaining its value for the entire program. Explain the visibility and lifetime of these variables. (5 marks)

(Total 25 marks)