UNIVERSITY OF ELDORET

University Examinations 2021/2022

YEAR TWO, FOUR SEMESTER ONE EXAMINATIONS FOR THE DEGREES OF
- **BACHELOR OF SCIENCE IN COMPUTER SCIENCE**
  - **BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**
- **BACHELOR OF SCIENCE IN APPLIED STATISTICS**
  - **BACHELOR OF SCIENCE IN ANALYTICAL CHEMISTRY**
  - **BACHELOR OF SCIENCE WITH EDUCATION**

COM 213: OBJECT ORIENTED PROGRAMMING

DATE: DECEMBER 2021   **TIME: 3 HOURS**

Instructions: Answer <u>all questions from section A</u> and any other <u>three questions from section B</u>.

Question 1 (12 Marks)

(a) (i) State the work of the following C++ operators.

(I) = **assigns value** to a **variable** (II) -= subtracts value of right operand and assigns result to variable **(2 Marks)**

(ii) What is a pointer? **(1 Mark)**

- a variable that stores memory address of an object

(b) Explain any <u>three</u> reasons as to why object oriented programming may be preferable by programmers as compared to procedural programming.

(3 Marks)

-allows for code reusability through inheritance
-Allows for data hiding through use of private members in classes
-files programming stores data permanently

(c) (i) What is another name of a member function? **(1 Mark)**

- method

(ii) What is another name of a static member variable? **(1 Mark)**

- **Class variable**

(iii) What is the name of the form of inheritance whereby a class has many sub-classes?

- **hierarchical** **(1 Mark)**

(d) Describe the importance of the inheritance feature in programming.

(3 Marks)

✓ **Allows for code reusability hence less chances of making errors**
✓ **Saves time in program development**

Question 2 (12 Marks)

(a) (i) Write the definition of a <u>function</u> named **valid** that receives the mark obtained in an exam (a number with decimal points) and returns either True (if the mark is between 0 and 100) or otherwise False. **(2 Marks)**

bool valid(int mark)
{
**   if (mark >=0 && <=100)**
{
return pass;
}
{
**   return false;**
}

(ii) Write a single sample statement to call the function.   **(1 Mark)**
bool valid();

(iii) Write a statement to declare an array named **t** for storing 50 float
numbers.   **(1 Mark)**
Float t[50];
(b) State the work of the following C++ operators.
(i)   :: - used in accessing global variable when there is local variable with
same name   (ii) this   - points to current instance of the class
(2 Marks)

(c) Write the definition of a <u>class</u> named **item** for storing items' names and their
prices, as well as a member function for inputting the details, and a
parameterized constructor. The member function and the constructor should
be defined outside the class.   **(6 Marks)**

SECTION B: ATTEMPT ANY <u>THREE</u> QUESTIONS FROM THIS SECTION

Question 3 (12 Marks)

(a) A student wrote the following program which is meant to input a positive
integer **x**, and then output the sequence 1 2 3 … **x** using a while loop.
However, it has some errors. Give <u>five</u> programming errors with the
program (State the line number and the error).   **(5 Marks)**

```
#include <iostream>
using namespace std ;semicolon misssing
/* main function /* -the Asterix should preceed /
int main()
{
    int c, x;
    cout<<"\nInput a positive integer", cin>>x; invalid
use of comma operator
    if (x<=0); -- semicolon shouldn't be used
       cout<<"\nNegative integer not allowed";
    Else    -else is in upper case
    {
       c=1;
       while (c<=x)
          cout<<c;
          c++;
    }
}
```

(b) (i) Write a <u>class</u> named **myclass** with a data member name **value** (a string).
The class should also have prototypes of the following member functions
which should also be defined outside the class;
- **assign()** that receives a string and assigns it to the data member.
- **get_value()** that returns the value of the data member.   **(5 Marks)**

(ii) Write sample brief code to declare objects of the immediate above class
and invoke the two operations appropriately.   **(2 Marks)**

Question 4 (12 Marks)

(a) Explain the importance of using <u>destructors</u> in programming.   **(2 Marks)**
**-used to deallocate memory & cleanup for a class object and its class
members when the object is destroyed/deleted.**

(b) (i) Give any <u>four</u> rules for a valid constructor in C++.   **(4 Marks)**

**-constructor name should be same as class name
- should not have a return type
- it cannot have any parameters**

(ii) Consider the following program.

```
#include <iostream.h>
class k
{     float code; };
void main()
{}
```

Required: Rewrite the program to illustrate the usage of the following: A copy constructor and a function to input the value of **code**. The two functions should be defined outside the class. Also, create objects such as to invoke the methods.   **(6 Marks)**

```
#include <iostream.h>
class k
{     float code; };
void main()
{
  k a;
  a.code();
}
```

Question 5 (12 Marks)
An employee in a particular sales company is either full time or part time. Full time employees are grouped into two – administrators and salesmen.

Details stored for a full time employee include a unique employee code, the employee's name and his/her contacts, salary, title, total sales made in the month (only for salesmen), and the job group (only for administrators). The operations performed here include registering a new employee, and computing the net salary (Tax is 20% of salary, allowances is 30% of salary plus a sales commission of 5 % (only for salesmen)).

Details stored for a part time employee include a unique employee's code, his/her name and contacts, title, and the employee's hourly pay rate. The operations performed on a part time employee include registering a new employee, and computing the monthly income (input total hours worked).

Required: Write down definitions of _classes_ using inheritance to implement the above.   **(12 Marks)**

Question 6 (12 Marks)
(a) (i)   Define the three types of polymorphism.   **(3 Marks)**
Runtime, overloading, compile-time

(ii) Explain the rules governing the use of a pointer to access members of the base class and the derived class. **(3 Marks)**
- ✓ **It must be initialized by valid memory address**
- ✓ **Stores only address of another variable**
- ✓ **In order to initialize 2 pointers with same reference, you can make assignment operation to them**

(iii) Write down the output of the following program. **(3 Marks)**

```cpp
#include <iostream>
using namespace std;

class classX
{
public:
    void a()    {   cout<<"\na of classX";   }
    virtual void b(){ cout<<"\nb of classX";   }
};

class classY: public classX
{
public:
    void a() {   cout<<"\na of classy";   }
    void b() {   cout<<"\nb of classy";   }
};

void main()
{   classX x;    classY y;    classX *p;
    p=&x; p->a(); p->b();
    p=&y; p->a(); p->b();
}
```

(b) Explain <u>two</u> major errors with the following program. **(3 Marks)**

```cpp
#include <iostream>
using namespace std;
class A
{
public:
    virtual void display()=0;
};
class B: public A
{
public:
};
void main()
{
    A a;
    a.display();
}
```

```
        B b;
        b.display();
    }
```

Question 7 (12 Marks)

The details stored for a book in a shop are the unique item code, name, price, as well as the stock, the author, the edition, the publisher and the year of publication. The details stored for an electronic item are unique item code, name, price, the stock, and the discount rate. The operations done on the items include registering a new item, outputting details of an item, selling an item (update stock appropriately), and computing the discount given (for electronics).

Required: Write down definitions of <u>classes</u> using polymorphism for the above.

(12 Marks)