UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE & ENGINEERING

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

SUPPLEMENTARY EXAMINATION

JULY 2017

TITLE OF PAPER: PROGRAMMING TECHNIQUES II

COURSE CODE: EEE272/EE272

DURATION: 3 HOURS

INSTRUCTIONS:

1. There are five (5) questions in this paper. Answer question 1 and any other three (3) questions.
2. Each question carries equal marks.
3. Use correct notation and show all your steps clearly in any program analysis.
4. All programs should be sufficiently commented and indented for clarity.
5. Start each question in a new page.

This paper should not be opened until permission has been given by the invigilator.

This paper contains seven (7) pages including this page.

Question 1

a. How are overloaded functions differentiated from each other when a program is executed? [2]

b. Define the principles of encapsulation and information hiding in object oriented programming. How does the definition of classes promote these principles? [4]

c. Explain why a class might provide set and get functions to update and access data members. [2]

d. What is the purpose of access specifiers? Explain the access control level provided by each access specifier. [6]

e. By using an example explain the difference between a base class and a derived class. [2]

f. What is a default class constructor? Describe two ways by which it can be created.[4]

g. What is "this" pointer? [2]

h. Explain how a program can ensure reusability of a class by other programs. [3]

Question 2

a. Carefully analyse the following programs, and show their outputs.

i. [2]

```
#include <iostream>

using namespace std;


void swap(int n1, int n2)

{

  int temp = n1;

  n1 = n2;

  n2 = temp;

}

int main()

{

  int a[] = {1, 2};

  swap(a[0], a[1]);

  cout << "a[0] = " << a[0] << " a[1] = " << a[1] << endl;
```

}

ii. [3]

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

class A
{
public:
    int x;
    int y;
    int z;

    A(): x(1), y(2), z(3)
    {
    }
};

int main()
{
    A a;
    cout << a.x << " " << a.y << " " << a.z;

}
```

b. Identify and describe all errors in the class definition shown below. Explain how these errors can be rectified. [6]

```cpp
class Jeans
{
private:
        int size;
        string brand;
public:
        Jeans()
        {
```

```
                        size = 10;
                        brand = "Levis";
                }
                int SetSize(int size)
                {
                        size = s;
                }

                void SetBrand(string b)
                {
                        brand = b;
                }
        };
        int main()
        {
                Jeans jeans;
                jeans.size = 8;

        }
```

c. The "broken" program shown below is expected to add three scores and return the average, however it is missing a constructor and has errors. You are required to add a constructor that will initialize the data members, and fix all the errors so that the program functions as expected.
[10]

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

        class Test
        {
        private:
                double total, score;
                int numberOfScores;

                double average()
                {
                        return total/numberOfScores;
                }
        public:

                void setScore(double score)
                {
                        this->score = score;
                }

                int getAverage()
                {
                        return average();
                }

                Test add(double t1)
                {
                        total += score;
                        return *this;
                }
        };
```

4

```
int main()
{
        Test test;
        test.add(50).add(76).add(37);
        cout<<"The average mark is "<<test.getAverage()<<endl;
}
```

d. Show the output of the following program, if you enter 1 0, what is the output of the following code? [4]

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

int main()
{
  // Read two integers
  cout << "Enter two integers: ";
  int number1, number2;
  cin >> number1 >> number2;

  try
  {
    if (number2 == 0)
      throw number1;

    cout << number1 << " / " << number2 << " is "
      << (number1 / number2) << endl;
  }
  catch (int e)
  {
    cout << "Exception: an integer " << e <<
      " cannot be divided by zero" << endl;
  }

  cout << "Execution continues ..." << endl;

  return 0;
}
```

Question 3

a. What is inheritance in object oriented programming? Discuss ways by which it contributes to software reuse and short turnaround times in program development.

[6]

Use the following class definitions to answer questions **b**, **c** and **d**.

```
class TVGame
{
protected:
        string host;
        string game;
public:
```

```
                TVGame(string h, string g);
                GoToCommercial();
                // add the StartGame function here
        };

        class Jeopardy : public TVGame
        {
        private:
                int score;
        public:
                Jeopardy(string h, string g, int s);
                // add StartGame function here
        };
```

b. Write the function body for the constructor of Jeopardy.   [2]
c. Write the function header for constructor of Jeopardy as it would appear in the
    implementation file, Jeopardy.cpp.   [3]
d. Assume a class is to be derived from Jeopardy, e.g., JuniorJeopardy. The new class
    should inherit all data members. Which key word in the Jeopardy class would need to
    change to make this possible?   [1]
e. Identify all errors in the following class definition, and then explain how to correct
    them.
                                                                          [3]

```
        class Example
        {
                public:
                        Example(int y = 10): data(y)
                        {
                                // empty
                        }

                        int getIncrementedData() const
                        {
                                return ++data;
                        }

                        static int getCount()
                        {
                                cout<<"Data is "<< data << endl;
                        }

                private:
                        int data;
                        static int count;
        };
```

f. How is it that polymorphism enables you to program "in the general" rather than in
    the "in the specific"? Discuss the key advantages of programming of programming
    "in the general".   [5]
g. Define the concept of friendship in object oriented programming. Some people are
    against this concept: Discuss the possible negative aspects of friendship.   [5]

6
```

# Question 4

Write a complete C++ program to do the following:

- Student is a base class, having two data members: entryno and name; entryno is an integer and name is of type characters, 20 characters long. The value of entryno is 1 for Science student and 2 for Arts student, otherwise it is an error.
- Science and Arts are two derived classes, having respectively data items marks for science and marks for arts.
- Read appropriate data from the keyboard for 3 science and 2 arts students.
- The two derived classes have members function display which is used to display entryno, name, marks for science students first and then for arts students.

|   |   |   |   |
|---|---|---|---|
| i.   | Write the C++ interface. | | [5] |
| ii.  | Write the C++ implementation. | | [15] |
| iii. | Write a C++ driver program for the class | | [5] |

# Question 5

a. Define a class named *LinearEquation* for a 2X2 system of linear equations:

$$ax + by = e \qquad\qquad x = \frac{ed-bf}{ad-bc} \qquad y = \frac{af-ec}{ad-bc}$$

$$cx + dy = f$$

The class should contain the following:
- Private data members a,b, c, d, e and f.
- A constructor with the arguments for a, b, c, d, e and f.
- Six get functions for a,b,c,d,e and f.
- A member function called is *isSolvable()* that returns true if $ad - bc$ is not 0.
- Member functions *getX()* and *getY()* that return the solution for the equation.

Write the implementation of the class and a test program that prompts the user to enter a,b,c,d,e and f, and displays the result. If $ad - bc$ is 0 report that "the equation has no solution".

Note:
- You are not required to separate the interface of the class from implementation.

[15]

b. Define a class named fruit and its three derived classes Apple, Banana and CitrusFruits. Make class GoldenDelicious and RedDelicious derived classes of Apple. A fruit has a name, color, weight and season of availability. A citrus fruit can be differentiated by how sour it is. You can define the degree of sourness as a range of

integer values e.g. 1 to mean very sour and 3 least sour. Do the same for apples interms of sweetness. Include a function print in fruit, and overidding print functions for all the derived classes.

[10]


**End of paper**