Department of Electrical & Computer Engineering

EE 553 – Engineering Programming: C++

Fall 2022 – Midterm Exam

Note

Please justify all your responses as much as you can.

Total points 100

Question 1: UML (10 points)

Create the unified modeling language (UML) for the following C++ code

```
class fraction{
private:
   int num; //  numerator
public:
   int den; // denominator
   fraction() : num(1), den(1){};
   fraction(int n, int d) : num(n), den(d){};
   fraction operator+(fraction f2){
      return fraction((this->num*f2.den + this->den*f2.num),    this->den*f2.den);}
   void print(){cout << this->num << " / " << this->den << endl;}
   friend ostream& operator<<(ostream& ostr, fraction f){
      ostr << f.num << " / " << f.den << endl;
      return ostr;
   }
};
```

Question 2: Conditional Statements (15 points)

Use the below C++ code to answer the following conditions

```
If (Name == "Diamond" && x > 10){
   money = 100 * x;
   bank += 1;
}
else {
   bank -= 1;
}
cout << money << " " << bank << endl;
```

- Write conditional operator short form for **if & else** condition example above
- What are the values of money and bank if Name = ”Silver” and original money = 0, bank = 50, and x = 100?
- What are the values of money and bank if Name = ”Diamond” and original money = 5, bank = 40, and x = 100?

Question 3: Bug fixes (15 points)

Find three distinct errors in the following program and suggest appropriate fixes

```
1  #include <iostream>
2  using namespace std;
3
4  class Shape{
5
6  public:
7      int l,w;
8
9      void set_values(int l, int w){
10         this->l=l;
11         this->w=w;
12     }
13
14     void show_data(){
15         cout<<l<<endl;
16         cout<<w<<endl;
17     }
18
19     float area (){}
20 };
```

```
21 class Rect:Shape{
22 public:
23        float area (){
24               return (l*w);
25        }
26 };
27
28 int main (){
29
30     Rect r;
31     r.set_values(2,3);
32
33     r.show_data();
34
35     Shape *s=&r;
36     s.area();
37
38     return 0;
39 }
```

NO.	Line	Error	Correction
1	----------	----------	----------
2	----------	----------	----------
3	----------	----------	----------

Question4: C++ Concepts - True/False (10 points)

1. We can access the static variables with the class name. [ ]
2. In C++, assigning a pointer to a pointer does not involve copying the object. [ ]
3. In C++, dynamic memory allocation is done using malloc. [ ]
4. In C++, a constructor is a public class function that get called whenever an object's destroyed. [ ]
5. The Addition operator (+) is the only operator which overloaded by default. [ ]

Question 5 C++ Classes and functions (10 points)

Write a class Calculator that holds two integer values x,y set by the class constructor. The class also contains a member function div that return x/y. The class should handle the possible exception in case (y=0)

Write main function to test the implementation of the Calculator class

//Write Calculator class code here	//Write main function code here

Question 6 Pointers and Access Specifiers (15 points)

Given the below code, try to answer the following questions

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

class Triangle
{

public:
    float width, height;
public:
    void set_data (float a, float b){
        width = a;
        height = b;
    }
    float area (){
        return (width * height / 2);
}
};

int main (){

    Triangle tri;
    tri.set_data (2,5);

    cout << tri.area() << endl;
    return 0;
```

1. What is the output of line 24?	Output:
2. Replace line 7 with **private:** and recompile your program. What is the result? Explain.	Expected:
3. Remove line 9 and recompile your program. What is the result? Explain.	Expected:
4. Define a new pointer ***tri_p** in line 23 and initialize with the object **tri.**	Write this line of code:

5. Rewrite this program and replace the **set_data** function by a constructor, and define **area()** function to be external function.	//Constructor:
	
	// area function

Question 7 C++ Concepts - multiple choices (15 points)

a. Dynamic memory in C++ is allocated from which type of memory
   a) Static
   b) Stack
   c) Heap
   d) Program once

b. _____ is a restricted pointer that cannot be used to change the value to which it points
   a) Constant Pointer
   b) Null Pointer
   c) Pointer to a constant
   d) All of the above

c. In C++, which of the following is/are valid ways to allocate memory for an integer by dynamic memory:
   a) int *p = new int (100)

b) int *p; p = new int; *p=100;
c) int *p=NULL; p = new int; *p = 100;
d) Only a and b
e) All of the above

d. ___ is the de-reference operator which is used to de-reference a pointer to access the value to which it points
   a. &
   b. *
   c) dot notation
   d) None of the above

e. ___ is a pointer whose address cannot be changed after initialization
   a. Constant Pointer
   b. Null Pointer
   c) Pointer to a constant
   d) None of the above

Question 8 True or false – Explain (10 points)

a) In the following class,
   Is foo will be constructed before bar? Explain?

```
#include "Mucus.h"
class Marvin {
        public:
                Marvin() : bar(2), foo(3) {}
                Mucus foo; Mucus bar;
};
```

Answer:

b) Explain if the following statement is true or false, why?
   Passing a data member as an argument in the initializer list is dangerous because the data member will not have been properly initialized. For example, the following constructor is potentially error-prone:

```
#include "Game.h"
#include "Player.h"
class Taboo : public Game {
         public:
                 Taboo() : Game(mPlayer) {}
        protected:
                Player mPlayer;
};
```

Answer: