NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY
FSCS, Midterm Examinations Spring 2024

Time: 90 minutes **Max Marks: 20**

Object Oriented Programming (CT-260)

Paper – B **Date: 24-05-2024**

Note: Attempt all questions.

1. Answer the following short questions. [CLO-1, Marks 05]
   a. **Why** we overload constructors? Define copy constructor.
   b. **What** is the purpose of using static data member and method in OOP? Can you process non-static data members in a static method?
2. **Construct** a set of classes that allows you to represent different types of employees: FullTimeEmployee and PartTimeEmployee, and also **draw** a UML class diagram. Each of the classes will contain attributes that are specific to it, such as salary for FullTimeEmployee, and hourly pay for PartTimeEmployee. In each of the classes, there will be a method for calculating the amount earned per month. Construct a base class Employee containing a member function calculateMonthlyEarnings. Two classes will inherit Employee: Full-time and Part-time. All classes override the function they inherit from the base class. The earnings are calculated based on following rules: FullTimeEmployee: The monthly earnings for a full-time employee can be calculated by simply using their fixed salary. PartTimeEmployee: The monthly earnings for a part-time employee can be calculated by multiplying their hourly wage with the number of hours they work in a month. [CLO-2, Marks 05]
3. **Construct** a custom matrix class in C++ with the following requirements: (a) Overload the equality (==) operator to check if two matrices are equal, (b) Overload the subtraction (-) operator to subtract one matrix from another. Assume that your class handles 3x3 matrices only. Also, provide appropriate error messages for invalid operations, such as attempting to subtract matrices with incompatible dimensions, etc. Demonstrate use of both the overloaded operators in main(). [CLO-2, Marks 05]

4. Find the error(s) in each of the following and explain how to correct it (them) or predict the output. [CLO-1', Marks 05]

(a)
```
class Base {
protected:    int protectedVar;
public:
   Base() : protectedVar(0) {}
   void setProtectedVar(int value) {
      protectedVar = value;}
   int getProtectedVar() {
      return protectedVar; } };
class Derived : protected Base {
public:
   void printProtectedVar() {
      cout << protectedVar;  } };
int main() {
   Derived derivedObj;
   derivedObj.setProtectedVar(10);
   cout << derivedObj.getProtectedVar();
   derivedObj.printProtectedVar(); }
```

(b)
```
class Complex {
private:  float real, imag;
public:
   Complex(float r=0, float i=0) : real(r),
imag(i) { }
   Complex Add(Complex const &obj) {
      Complex res;
      res.real = real + obj.real;
      res.imag = imag + obj.imag;
      return res;  }
   void display() {
      cout << real << imag << endl; }
};
int main() {
   Complex c1(3, 2), c2(1, 7);
   Complex result = c1 + c2;
   result.display(); }
```

(c)
```
class String {
private: char *str;
public:
   String(const char *s) {
      str = new char[strlen(s) + 1];
      strcpy(str, s);}
   void display() {
      cout << str << endl;}
   void change(const char *s) {
      strcpy(str, s);}
   ~String() { delete [] str; }  };
int main() {
   String s1("Hello");
   String s2 = s1;
   s1.display(); s2.display();
   s1.change("World");
   s1.display();   s2.display(); }
```

(d)
```
class MyClass {
public:
   static int count;
   MyClass() {  count++;   }
   ~MyClass() {  count--;   }};
int MyClass::count = 0;
int main() {
   MyClass obj1;
   MyClass *ptr = new MyClass;
   cout << MyClass::count;
   delete ptr;
   cout << MyClass::count; }
```

(e)
```
class B;
class A {
   int x;
public:   A() : x(0) {}
   void setData(int a) {x = a; }
   friend void add(A, B); };
class B {
   int y;
public:   B() : y(0) {}
   void setData(int b) { y = b; } };
   void add(A objA, B objB) {
   cout << objA.x + objB.y;}
```