22-4-16

Indian Institute of Engineering Science and Technology, Shibpur
Dual Degree B.Tech & M.Tech (CST) 4th Semester Examination, April 2016

Programming Paradigms (CS - 403)

Time: 3 hours **Full marks: 70**

Answer questions from both groups in same answer script

Group A : Attempt both questions from this group (2x10=20)

1. **Mandatory Question**: Mention the correct answer.

a) Haskell follows which programming paradigm?
i) Functional ii) Logic iii) Object Oriented iv) Imperative

b) In UML, to which view does "Sequence Diagram" belong?
i) Structural ii) Implementation iii) Behavioural iv) Users

c) Which of the following statements regarding "inline functions" is correct?
i) Slows down execution and decreases the executable code size
ii) Speeds up execution and decreases the executable code size
iii) Slows down execution and increases the executable code size
iv) Speeds up execution and increases the executable code size

d) Mention the output of the following C++ code snippet

```
class CBase { }; // an empty class
class CDerived : public CBase {  char a; };
int main() {
   cout << sizeof(CBase) << "," << sizeof(CDerived) << endl;
}
```

i) 0,1 ii) 1,1 iii) 1,2 iv) None of these

e) To support statement like "`obj1 = 10 + obj2;`" (where `obj1` and `obj2` are instances of `MyClass` mentioned below), the operator + can be overloaded using -

```
class MyClass {
      int data1; int data2;
      public: ... // class has member functions
};
```

i) Member function only ii) Friend function only
iii) Both using member and friend functions iv) Cannot be done

f) Consider the sentence: "*A book has one or more page(s)*". Which of the following concepts characterize it best in Class relationship?
i) Aggregation ii) Specialization iii) Association iv) Composition

g) Which operator(s) is/are part of RTTI?
i) `dynamic_cast` ii) `typeid` iii) Both i & ii iv) None of these

h) The actual source code for implementing a template function is created when
i) The function is actually executed ii) The declaration of the function appears
iii) The definition of the function appears iv)The function is invoked

i) In C++ `class CDerived : public CBase1, public CBase2 {...}` is an example of which kind of inheritance
i) Hybrid ii) Multilevel iii) Hierarchical iv) Multiple

j) Which is true for following C++ code?

```
class Base  {
    protected: int *bPtr;
    Base() : bPtr(new int) {}
    ~Base() {  delete bPtr; };
};
class Derived : public Base {
    int ** dPtr;
    public:  Derived() : dPtr (new (int *)) {
        *dPtr = bPtr; }
    ~Derived() { delete dPtr; };
};
int main() {
  Derived *d = new Derived();
  delete d;
}
```

i) Perfect code executes without any issue ii) Segmentation fault - double free problem
iii) `~Base()` should be made `virtual` to avoid memory leak iv) Compilation Error

[10x1]

2. **Mandatory Question**: Design a class `LibraryBookRecord` using C++ that has following attributes and behaviors. Use your own judgment to select data types and proper access specifiers with justification for various attributes and behavior of the class.
Attributes: `BookName, UniqueNumber, CurrentPrice, UserBorrowed`
Behavior: `Constructor(s), Destructors, CopyConstructor, IssueBook(...), ReturnBook(...), SetPrice(...), GetTotalBookCount(...).`

[10]

Group B : Attempt any 5 questions from this group (5x10 = 50)

3. a) What do you understand by side effect of Imperative Programming?
b) Why sometime "`new`" and "`delete`" operators are required to overload in C++?
c) In C++, what is "Initialization list" and when it must be used?

[4+3+3]

4. a) What is Singleton class? Explain using C++ code.
   b) Explain "Template Class" using C++ example code?
   c) What is "`this`" pointer in C++?

[5+3+2]

5. a) Explain Association class relationship with suitable example.
   b) Explain dangling reference and memory corruption using an example code?
   c) What is abstract class in C++? What's the need of it?

[4+3+3]

6. a) Why UML Use case diagram factoring is required?
   b) Explain Use case factoring using "include" and "extend" relationship using suitable example.
   c) Explain the need of virtual function in C++ using a sample code.

[2+5+3]

7. a) What is "identity" and "state" of an Object?
   b) Explain "Virtual Class" in C++ using a suitable example.
   c) Why a derived class pointer/reference cannot point to base class object?

[4+4+2]

8. a) What is virtual-Table and virtual-Pointer in C++?
   b) What is Multi-level Inheritance? Explain using a C++ sample code?
   c) In UML use case diagram why actor identification is important?

[4+4+2]

9. a) Write a program in Scheme LISP to evaluate

$$\frac{6+\frac{1}{2}+\left(7-(3+\frac{1}{3})\right)}{\frac{1}{4}(5-2)}$$

   b) Write a program in Scheme LISP to compute N^{th} term of Fibonacci sequence taking N as user's input.
   c) Consider m and n be two non negative integers. Develop a Scheme LISP function for the following -

A(m, n)	= n+1	if m=0
	= A(m-1, 1)	if m>0, n=0
	= A(m-1, A (m, n-1))	if m>0, n>0

[2+4+4]

10. Write short notes on following -
    a) Functional Programming Paradigm
    b) UML Views and Diagrams

[5x2] = 10