University of Colombo, Sri Lanka

University of Colombo School of Computing

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

First Year Examination — Semester II– 2021/2022

SCS1209 — Object Oriented Programming - Part B

(Two (2) Hours for both part A & part B)

Answer ALL questions

Number of Pages = 10 Number of Questions = 2

To be completed by the candidate								
Index Number								

Important Instructions to candidates:

- The medium of instruction and questions is **English**.
- **Write your answers in English.**
- Note that questions appear on both sides of the paper. If a page is not printed, please inform the supervisor immediately.
- Write your index number on each and every page of the question paper.
- The duration of the paper is **Two (2)** hours for **both parts A & B.**
- This paper, **part B** has **2** questions on **10** pages.
- Answer **all** the questions in this **part B**
- Each question carries exactly **25 marks.**
- **Write your answers on the space provided** on this question paper.
- Any electronic device capable of storing and retrieving text including electronic dictionaries and mobile phones are **not allowed.**

To be completed by the examiners

1	
2	
Total	

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1. (a). Only ONE answer is correct in the following 12 MCQs. Underline the **most suitable answer** among the given options.

[2 x 12 marks]

i. Consider the following three (3) statements regarding the Inheritance.

A. Wheel and Car has the relationship define as Inheritance.
B. One derived class can be inherited from multiple base classes.
C. All the public functions in the derived class can be accessible from the base class.

Which of the above statements are TRUE?

A. B only.
B. C only.
C. A and C only.
D. B and C only.
E. A, B and C.

ii. Which of the following is TRUE according to the following class definition?

```
class A: protected B {
// body of the class
};
```

A. Both public and protected data in B will become protected to A
B. Both public and protected data in A will become protected to B
C. A can access only protected data in B
D. Only protected data in B will become protected to A
E. All public, protected and private data in B will become protected to A

iii. Consider the following three (3) statements regarding inheriting constructors.

A. The constructors are invoked in the order of derivation. Ie, Derived class constructor first and then the Base class constructor.
B. Base class constructors can call derived class constructors.
C. If more than one constructor available on the base class, the default constructor will be invoked automatically, unless no base class constructor called explicitly.

Which of the above statements are TRUE?

A. A only.
B. A and B only.
C. A and C only.
D. C only.
E. A, B and C.

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iv. Consider the following 3 statements regarding the `Virtual Functions`?

A. It is one of the solutions for the Diamond problem.
B. It is mainly used to achieve compile time Polymorphism.
C. It is mandatory to override the virtual functions.

Which of the above statements are TRUE?

A. A only.
B. B only.
C. C only.
D. A and C only.
E. A, B and C.

v. Following is the definition of the `fly()` function in the class named `Bird`.

```
virtual int fly(int x=0) = 0;
```

Which of the following is FALSE regarding the above code?

A. This fucntion returns 0 when it calls.
B. `Bird` class is an Abstract class.
C. It is not mandatory to pass an integer when calling this function.
D. You will get a compiler error if you remove the keyword `virtual`
E. `fly()` function must be implemented in a derived class of `Bird`.

vi. What is the output of the following program?

```
1  class Shape {
2    int x, y;
3    public:
4      int calcArea(int x) { return x*x; }
5      double calcArea(int y) { return y/2; }
6  };
7  int main() {
8    Shape obj;
9    cout<<obj.calcArea(10)<<", ";
10   cout<<obj.calcArea(20);
11 }
```

A. 100, 400
B. 100, 10.0
C. 5.0, 10.0
D. Compilation error
E. Runtime error

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vii. Which of the following is FALSE concerning *function overriding*?

A. It is a must to have the `override` keyword to override a function.
B. Signature of the function will remain same after overriding.
C. having a virtual function in the base class is optional to override a function.
D. `override` keyword helps to override the correct function, but complier does not need it.
E. Runtime Polymorphism will be achieved by function overriding.

viii. What is the output of the following program?

```
template <typename T, typename U>
U myMin(T x, U y) {
    return (x < y)? x: y;
}

int main() {
   cout << myMin<int, double>(8, 7.3) << ", ";
   cout << myMin<double, int>(2.9, 1.8);
}
```

A. 7.3, 1
B. 7.3, 1.8
C. 7, 1
D. 7, 1.8
E. Compilation error

ix. What is the output of the following program?

```
template <typename T, char c>
T func(T x) {
    return x+c;
}

int main() {
   cout << func<int, 'A'>(2) << ", ";
   cout << func<char, 65>(2);
}
```

Hint: `ASCII value of 'A' is 65`

A. C, C
B. 67, 67
C. C, 67
D. 67, C
E. Compilation error

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x. Which of the following is TRUE concerning the Arithmetic errors of a program?

A. Arithmetic error is a type of logical error.
B. Python interpreter can detect the arithmetic errors.
C. Arithmetic errors do not harm for the outcome of the program.
D. Arithmetic errors occurs because of incorrect syntax of your code.
E. Your code does not compile if you have an arithmetic error in your program.

xi. What is the output of the following program?

```
int main() {
  int x = 10;
  try {
    throw x;
    cout << "P "; }
  catch (int y) {
    cout << "Q "; }
  catch (...) {
    cout << "R "; }
  cout << "S ";
}
```

A. PQRS
B. PQS
C. QRS
D. QS
E. RS

xii. What is the output of the following program?

```
class A {
  public:
    A() { cout<<"X "; }
    ~A() { cout<<"Y "; }
};
class B {
  public:
    B() { cout<<"K "; }
    ~B() { cout<<"L "; }
};
int main() {
  try {
    A a; B b;
    throw 10; }
  catch (...) {
    cout << "Z "; }
}
```

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A. XYKLZ
B. XKYLZ
C. XKYL
D. XKLYZ
E. XKLY

(b). What is the output of the following program written in C++?

```
class A {
  public:
    A() { cout<<"X "; }
};

class B: public A {
  public:
    B() { cout<<"K "; }
};

int main()  {
  B b;

  try {
    throw b;
  }
  catch (A a) {
    cout << "Y "; }

  catch (B b) {
    cout << "Z"; }
}
```

.....

[1 marks]

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2. (a). Consider the following program code written in C++.

```
1  class A {
2    int x;
3  public:
4    void setX(int i) {x = i;}
5    void print() { cout << x; }
6  };
7
8  class B:  public A {
9  public:
10   B()  { setX(10); }
11 };
12
13 class C:  public A {
14 public:
15   C()  { setX(20); }
16 };
17
18 class D: public B, public C { };
19
20 int main() {
21     D d;
22     d.print();
23 }
```

i. What is the outcome of the above program? Briefly explain why.

[2 marks]

ii. What modifications you have to do for the above code if you need to print 20 as the output? (write only the affected lines with its original line number)

[2 marks]

iii. What modifications you have to further do for the modified code (in ii above) if you need to print 10 as the output? (write only the affected lines with its original line number)

[2 marks]

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(b). Give examples for the `Compile time polymorphism` and `Runtime polymorphism`. (Note that the marks are given only for the examples.)

Compile time polymorphism:

Runtime polymorphism:

[6 marks]

(c). Output of the following program (written in C++) is given below;

Program:

```
int main()  {
   cout << func<int , 10>(20) << endl;
   cout << func<double , 1>(7.25) << endl;
}
```

output:

```
30
8.25
```

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i. Implement the template named `func` which gives the above output.

[6 marks]

ii. write the code line inside the main() function to get letter `D` as the output, by calling the above template.

[2 marks]

(d). The function named `ABC(char )` in the following program will return an exception *"the integer value of the given character"* when the character is a non-capital letter, and will return the character itself otherwise.

Hence, it prints
`A` when `ch='A'`
`Z` when `ch='Z'`
`97` when `ch='a'`
`49` when `ch='1'`

```
int main() {
  try {
    char ch = 'A'
    cout<<ABC(ch);
  }
  catch(int x) {
    cout << x;
  }
```

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```
}
```

Implement the function `ABC(char )` which gives the above output.

[5 marks]

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