SWE 4201: Object Oriented Concepts - I

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them **including Question no. 1 and 4.**
Figures in the right margin indicate marks.

[Mandatory]

1. a) Identify 10 objects from the paragraph below. For each of the objects, mention to which type the object belongs to. You may identify multiple objects of same type. Note that, the type of object may or may not be mentioned in the paragraph. **10**

   "The Battle of Uhud was a battle between the early Muslims and the Qurayshis of Makkah. The battle took place near Mount Uhud, to the north of Medina. The Qurayshi army was led by Abu Sufian, Khalid Ibn Walid, 'Amr Ibn al-'As. Interestingly, all three of them later converted to Islam and played significant role in Muslim army. The Battle of Uhud resulted in a lot of loss to Muslims, including death of Hamza (R). The grave of Hamza (R) and many other Martyrs of Uhud are near the mountain."

   b) Give the object oriented terminology for each of the following features: **8**
      i. Pattern or blueprint for creating an object
      ii. Characteristics that describe an object
      iii. Actions that objects perform or operations which are performed to an object
      iv. Hiding the internal details of an object from the user
      v. Capability of creating a new class from an existing class
      vi. A class from which another class inherits its attributes and behaviors
      vii. A newly created class, derived from another which inherits all of the attributes and behaviors, but may have additional attributes and behaviors associated with it
      viii. Multiple forms of the same method, where the exact same method name can be used in different classes, or the same method name can be used in the same class with different parameters

   c) What are the uses of a constructor? Sometimes there is a need of initializing an object in different ways. How can we do that? Explain the order of execution of constructors in multilevel inheritance? **2+3 +2**

2. a) Explain the followings with suitable example using an object oriented programming language. **10 + 6**
      i. Overloading vs Overriding
      ii. Multilevel Inheritance

   b) What is abstraction? Give two examples of abstraction. How do we implement abstraction in Java? **5**

   c) Differentiate between static and dynamic polymorphism. **4**

3. a) Define the following terms: class variable, instance variable, argument variable and local variable. Also mention the scope/lifetime of each of them. **13**

   b) Briefly comment on the following statements from Java language point of view: **12**
      i. Irrespective of the presence of any constructor in a class, the compiler will provide a default constructor
      ii. Methods and fields of an interface

iii. A class can extend a final class

iv. Abstract constructor

v. A child class that extends an abstract class needs to implement the abstract methods of its parent class

vi. In method overloading, we can create an overloaded method by changing the return type of the method.

[Mandatory]

4. a) Organize the following classes into inheritance hierarchies and where appropriate create new classes: Building, StoryBook, FootballTournament, Bedroom, Kitchen, AcademicBuilding, Classroom, Helicopter, ThesisBook, AdministrativeBuilding, CricketTournament, SportsTournament, Rocket. 15

b) Write down the output of the listing 1 and listing 2. Explain the steps of execution of the listings to get the output. 4+6

```java
class A {
    int i;
    A() {
        i = 10;
    }
}
class B extends A {
    B() {
        i = 20;
    }
}
public class MainClass {
    public static void main(String[] args) {
        A a = new B();
        System.out.println(a.i);
    }
}
```

Listing 1: Code snippet (in Java) for Question 4.b.

```java
class Printer {
    void print() {
        System.out.println("Printing normal papers.");
    }
}
class LaserPrinter extends Printer {}
class DotMatrixPrinter extends Printer {
    void print() {
        System.out.println("Printing for special purpose.");
    }
}
public class MainClass {
    public static void main(String[] args) {
        Printer p = new Printer();
        p.print();
        p = new LaserPrinter();
        p.print();
        p = new DotMatrixPrinter();
        p.print();
    }
}
```

Listing 2: Code snippet (in Java) for Question 4.b.