1. The following Java applications contain errors. Point out the statement(s) that contain errors. Explain what each of the errors is, and how it can be fixed.

EX 1.1.

```
public class OOPExercises {
   public static void main(String[] args) {
      A objA = new A();
      System.out.println("in main(): ");
      System.out.println("objA.a = "+objA.a);
      objA.a = 222;
   }
}
```

```
public class A {
     private int a = 100;
     public void setA( int value) {
        a = value;
     }
     public int getA() {
        return a;
     }
} //class A
```

Point out the error(s) and how they can be fixed.

EX 1.2.

```
public class OOPExercises {
   public static void main(String[] args) {
      System.out.println("in main(): ");
      System.out.println("objA.a = "+getA() );
      setA(123);
   }
}
```

```
public class A {
     private int a = 100;
     public void setA( int value) {
        a = value;
     }
     public int getA() {
        return a;
     }
} //class A
```

Point out the error(s) and how they can be fixed.

EX 1.3.

```
public class OOPExercises {
   public static void main(String[] args) {
      A objA = new A( );
      double result;
      result = objA.getA( );
      System.out.println("objA.a = "+ result);
   }
}
```

```
public class A {
    private int a = 100;
    public void setA( int value) {
       a = value;
    }
    public int getA() {
       return a;
    }
} //class A
```

Point out the error(s) and how they can be fixed.

EX 1.4.

```
public class B extends A {
   private int a = 222;

   public static void main(String[] args) {
      System.out.println("in main(): ");
      System.out.println("a = "+a );
      a = 123;
   }
}
```

```
public class A {
    private int a = 100;
    public void setA( int value) {
       a = value;
    }
    public int getA() {
       return a;
    }
} //class A
```

Point out the error(s) and how they can be fixed.

2. Show the output of the following applications.
   EX 2.1.

```
public class OOPExercises {
   public static void main(String[] args) {
      A objA = new A();
      B objB = new B();
      System.out.println("in main(): ");
      System.out.println("objA.a = "+objA.getA());
      System.out.println("objB.b = "+objB.getB());
      objA.setA (222);
      objB.setB (333.33);
      System.out.println("objA.a = "+objA.getA());
      System.out.println("objB.b = "+objB.getB());
   }
}
```

Output:

```
public class A {
    int a = 100;
    public A() {
       System.out.println("in the constructor of class A: ");
       System.out.println("a = "+a);
       a = 333;
       System.out.println("a = "+a);
    }
    public void setA( int value) {
       a = value;
    }
    public int getA() {
       return a;
    }
 } //class A
```

```
 public class B {
    double b = 123.45;
    public B() {
       System.out.println("-----in the constructor of class B: ");
       System.out.println("b = "+b);
       b = 3.14159;
       System.out.println("b = "+b);
    }
    public void setB( double value) {
       b = value;
    }
    public double getB() {
       return b;
    }
 } //class B
```

EX 2.2.

```
public class OOPExercises {
   public static void main(String[] args) {
      //A objA = new A();
      B objB = new B();
      System.out.println("in main(): ");
      //System.out.println("objA.a = "+objA.getA());
      System.out.println("objB.b = "+objB.getB());
      //objA.setA (222);
      objB.setB (333.33);
      //System.out.println("objA.a = "+objA.getA());
      System.out.println("objB.b = "+objB.getB());
   }
}
```

Output:

```
public class A {
    int a = 100;
    public A() {
       System.out.println("in the constructor of class A: ");
       System.out.println("a = "+a);
       a = 333;
       System.out.println("a = "+a);
    }
    public void setA( int value) {
       a = value;
    }
    public int getA() {
       return a;
    }
 } //class A
```

```
 public class B extends A {
    double b = 123.45;
    public B() {
       System.out.println("-----in the constructor of class B: ");
       System.out.println("b = "+b);
       b = 3.14159;
       System.out.println("b = "+b);
    }
    public void setB( double value) {
       b = value;
    }
    public double getB() {
       return b;
    }
 } //class B
```

EX 2.3.

```
public class OOPExercises {
   static int a = 555;

   public static void main(String[] args) {
      A objA = new A();
      B objB = new B();
      System.out.println("in main(): ");
      System.out.println("a = "+a);
      a = 444;
      System.out.println("objB.a = "+objB.getA());
      objA.setA (77777);
      objB.rollBackA();
      System.out.println("After roll back -----");
      System.out.println("a = "+a);
      System.out.println("objA.a = "+objA.getA());
      System.out.println("objB.a = "+objB.getA());
   }
}
```

Output:

```
public class A {
   int a = 100;
   public A() {
      //System.out.println("in the constructor of class A: ");
      //System.out.println("a = "+a);
      a = 333;
      //System.out.println("a = "+a);
   }
   public void setA( int value) {
      a = value;
   }
   public int getA() {
      return a;
   }
} //class A
```

```
public class B extends A {
   private int a = 123;
   public B() {
      a = 2222;
   }
   public void rollBackA () {
      a = super.getA();
   }
   public void setA( int value) {
      a = value;
   }
   public int getA() {
      return a;
   }
} //class B
```

EX 2.4.

```
public class OOPExercises {
   static int a = 555;

   public static void main(String[] args) {
      A objA = new A();
      B objB1 = new B();
      A objB2 = new B();
      C objC1 = new C();
      B objC2 = new C();
      A objC3 = new C();
      objA.display();
      objB1.display();
      objB2.display();
      objC1.display();
      objC2.display();
      objC3.display();    }
}
```

Output:

```
public class A {
   int a = 100;
   public void display() {
      System.out.printf("a in A = %d\n", a);
   }
} //class A
```

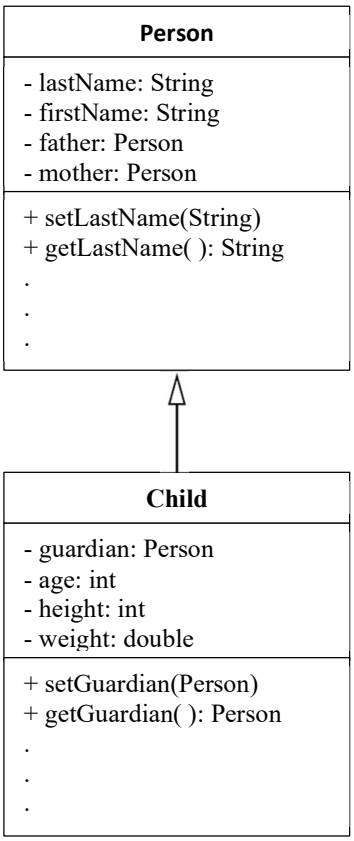
```
public class B extends A {
   private int a = 123;
   public void display() {
      System.out.printf("a in B = %d\n", a);
   }
} //class B
```

```
public class C extends B {
   private int a = 543;
   public void display() {
      System.out.printf("a in C = %d\n", a);
   }
} //class C
```

3. UML Diagrams

EX 3.1. Draw a UML class diagram (with associations) to show the design of the Java application in EX 2.2.

EX 3.2. The partial design of a Java application for a child care center is given in the following UML diagram. Note that the diagram is not complete. How do you represent the following relationships in the design: *father*, *mother*, and *guardian*? Revise the diagram to include those relationships in the design.



EX 3.3. Implement the design in EX 3.2 as a Java application. Add the *set* and *get* methods for each of the attributes. Note that Child is a subclass of Person.