

Exercise 1 – Classes and Objects

Section 1:

1. What is the essential difference between a local variable and a field?

The difference between a local variable and field is:

- A local variable is local to a method.
- An instance field is the field of an instance of a class i.e. an object.

2. Write statements that could be used to create an object of type Fraction representing the

fraction $\frac{1}{5}$

```
Fraction fraction = new Fraction ();  
fraction.num = 1;  
fraction.den = 5
```

3. Assuming that two objects f1 and f2 of type Fraction have been created and assigned values, write statements to perform each task.

(a) Double the value of f1.

```
f1 = f1 * 2
```

(b) Invert f2.

```
int temp = f2.num;
```

```
f2.num = f2.den
```

```
f2.den = temp
```

(c) Make f1 equal to the (unsimplified) product of f1 and f2

```
double f1 = (f1.num/f2.den)*2
```

.

(d) Make f2 equal to the (unsimplified) sum of f1 and f2.

```
double sum = f1+f2
```

```
f2 = sum;
```

(e) Make f1 equal to |f1|.

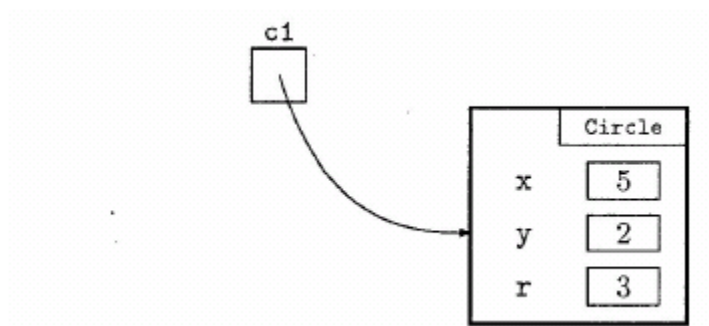
```
double absolute = Math.abs(f1.num/f1.den);
```

```
f1.num = absolute
```

4. A circle in the Cartesian plane can be described uniquely by its centre and its radius. Thus, a class called Circle that could be used to represent such circles might start with the following:

```
class Circle
{
    double x;    // x-coordinate of centre
    double y;    // y-coordinate of centre
    double r;    // radius
}
```

An object of this class, representing a circle with centre at (5,2) and having radius 3 is shown in the next diagram.



Using this class, write a Java program that performs the following actions.

- (a) Create Circle objects c1 and c2 where c1 represents a circle with centre at (1,2) having radius 4 while c2 represents a circle with centre at (-2,0) having radius 2.

```
Circle c1 = new Circle ();
```

```
Circle c2 = new Circle ();
```

```
// Assigns c1 the values of center (1,2) and radius 4.
```

```
c1.x = 1;
```

```
c1.y = 2;
```

```
c1.r = 4;
```

```
// Assigns c2 the values of center (-2,0) and radius 2
```

```
c2.x = -2;
```

```
c2.y = 0;
```

```
c2.r = 2;
```

(b) Set the double variable distance to the distance from the origin to the centre of c1 and then print this value.

```
double distance;
```

```
distance = Math.sqrt(Math.pow(c1.x,2) + Math.pow(c1.y,2));
```

```
System.out.println(distance);
```

(c) Set the double variable centreSeparation equal to the distance between the centres of c1 and c2 and then print this value.

```
double distance;
```

```
distance = Math.sqrt(Math.pow(c1.x,2) + Math.pow(c1.y,2));
```

```
System.out.println(distance);
```

```
//PART C
```

```
Double centreSeparation = Math.sqrt(Math.pow((c1.x - c2.x), 2) +  
Math.pow((c1.y - c2.y), 2));
```

```
System.out.println(centreSeparation);
```

(d) Set the double variable minDistance to the minimum distance from a point on c1 to a point on c2 and then print this value.

```
Double minDistance = Math.sqrt(Math.pow(((c1.x + c1.r) - (c2.x + c2.r)), 2) +  
Math.pow((c1.y - c2.y), 2));
```

```
System.out.println(minDistance);
```

Section 2:

5. **Class fields are considered attributes of an object. Although different objects do not necessarily need to have the same values, every object created should contain that field (e.g. every fraction should have a (num and a den, although the values can be different). What fields would you include for the following class of objects? State why you think these fields are important.**

a. A student in this school

```
class StudentInThisSchool {  
    int studentNumber;           //To give all students an identity  
    double marks;                //To keep track of students academics progress  
    String studentCourses;       //To keep track of students courses  
}
```

b. Cell phone

```
class Cellphone {  
    String contactName;          //To identify the number of the contact  
    int cellphone;               //To store the cell phone number of the contact  
}
```

c. Laptop Computer

- int/String password - Gives the laptop a sense of personal security

6. **Select a car from any manufacturer. Go to their website and determine appropriate fields for that type of car based on the specifications listed on their website. Include fields such as price, torque, and horsepower. Be sure to include fields that could change depending on the model selected.**

```
        Car ferrari488 = new Car ();  
        ferrari488.price = 410580;  
        ferrari488.torque = 770;  
        ferrari488.horsepower = 711;  
    }  
}  
  
class Car {  
    double price;  
    double torque;  
    double horsepower;  
}
```

7. In Java, create a class called *table* that is defined by the following fields. Make sure to use appropriate variable types.

- a. Height
- b. Length
- c. Width
- d. Legs
- e. Weight
- f. Shape
- g. Colour

```
class table {  
    double Height;  
    double Length;  
    double Width;  
    int Legs;  
    double Weight;  
    String Shape;  
    String Colour;  
}
```

8. Create a program that will create an object of type *table*. Assign values to the following fields

- a. Height = 3.3
- b. Length = -23.4
- c. Width = -1
- d. Legs = 0
- e. Weight = 4
- f. Shape = "square"
- g. Colour = "black"

```
table table = new table ();  
table.Height = 3.3;  
table.Length = -23.4;  
table.Weight = -1;  
table.Legs = 0;  
table.Weight = 4;  
table.Shape = "square";  
table.Colour = "black";
```

9. In the same program above, create another object of type *table*. Copy all the fields to the new object.

```
table table = new table();  
  
table.Height = 3.3;  
  
table.Length = -23.4;  
  
table.Weight = -1;
```

```
table.Legs = 0;
```

```
table.Weight = 4;
```

```
table.Shape = "square";
```

```
table.Colour = "black";
```