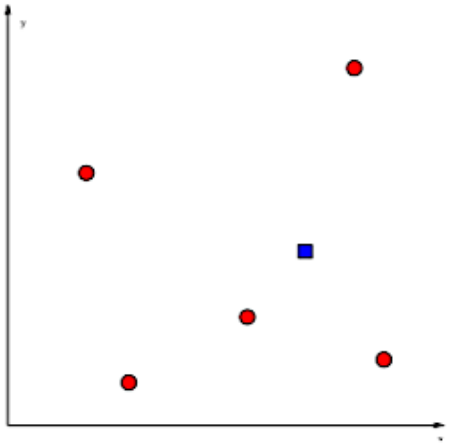
Java Assignment

Summary:
Your municipality searches the best place for installing a public waste dump. They want the dump to be as far as possible from the residential places. The residential places are represented by their coordinates x and y in a two-dimensional map. As the municipality has already a hint about the place where they want to place the dump, they want to verify that the distance between the desired position and the closest residency is reasonable and to place it in an optimal way close to the targeted place.

Here is an example of the data configuration (the circles represent the residencies and the square the desired position for the dump):



Instruction:
You should complete the given program to find the closest residency to the desired place for the dump, then find the ideal location.

The part of the code which is at your disposal defines an array which stores the coordinates of the residentials.

There is always an even number of entries in this table. The adopted convention is that for all even number i corresponding to a valid index of the array: tab[i] is the coordinate x of a residency and tab[i+1] is the coordinate y.

In the given file, define a method:

```
double calculateDistance(int x1, int y1, int x2, int y2)
```

which calculates and returns the distance between the two points (x1,y1) and (x2,y2) passed as arguments. For calculating the distance between two points (x1,y1) and (x2,y2), use the following formula :

$$\sqrt{(x1 - x2)^2 + (y1 - y2)^2}$$

Indication: For representing the greatest possible distance between the chosen point for the dump and a residency, you could use the Java constant Integer.MAX_VALUE.

Complete your program by defining the method:

```
int closest(int x, int y, int[] residentialsCoordinates)
```

where "residentialsCoordinates" is an array of coordinates for the residentials, as described above. The method closest should return the position (in the array "residentialsCoordinates") of the residential home (pair (x_p,y_p)) which is closest to the point (x, y). For example, consider the second residential (12, 55) in following array (33, 12, 12, 55, 12, 12), the method should return 1 (0-based). In case several residentials are candidates, closest will return the first occurance in the array.

Complete your program by defining an *additional* method:

```
int[] threeClosest(int x, int y, int[] residentialsCoordinates)
```

which returns in an array of integers the coordinates of *three* residentials closest to the point (x,y) passed as argument among all the residentials. The array will be organized according to the same conventions as the array for the coordinates of the residentials (x coordinates and then y coordinates). It will also be ordered from the closest to the farthest coordinate.

Note: To reach this result, you could copy the coordinates array to a temporary array using as follows:

```
System.arraycopy(residentialsCoordinates, 0, tmp, 0,
                 residentialsCoordinates.length);
```

then search three times the closest point in tmp. Every time that a closest point has been determined you should replace it by a point which is too distant to qualify as a new candidate.

Finally finish your program by defining the method:

```
int[] bestPlace(int x, int y, int[] residentialsCoordinates)
```

which gives the center of the triangle defined by the three residentials closest to the point (x,y). The returned array will therefore be an array with two entries where the first one will be the x coordinate and the second one the y coordinate of the center.

This « center » represents the best compromise for the three closest residencies. If (x_1,y_1), (x_2,y_2) and (x_3,y_3) are the closest points to the point (x,y), the coordinates (cx,cy) of the centre will be:

```
cx= (x1+x2+x3)/3
cy= (y1+y2+y3)/3
```

This example applies to the given array of residentials coordinates, which is:

```
int[] residentialsCoordinates = {
  9, 30, 18, 8, 3, 18, 25, 36
};

Enter the x coordinate of the discharge: 10
Enter the y coordinate of the discharge: 15
--- Question 1 ---
Coordinates of the nearest home to the discharge:
(3,18); distance = 7.616 meters
--- Question 2 ---
Coordinates of the 3 houses closest to the discharge:
(10,15) is a:
     7.616 to (3,18)
     10.630 from (18.8)
     15.033 from (9,30)
--- Question 3 ---
Coordinates of the best place for the discharge:
(10.18)
```