

## Formative Exercises

### Solution

#### Exercise 1 K-means

Jhon and Hanna should be together in group Maths1 with a center in (19.5,9.5)

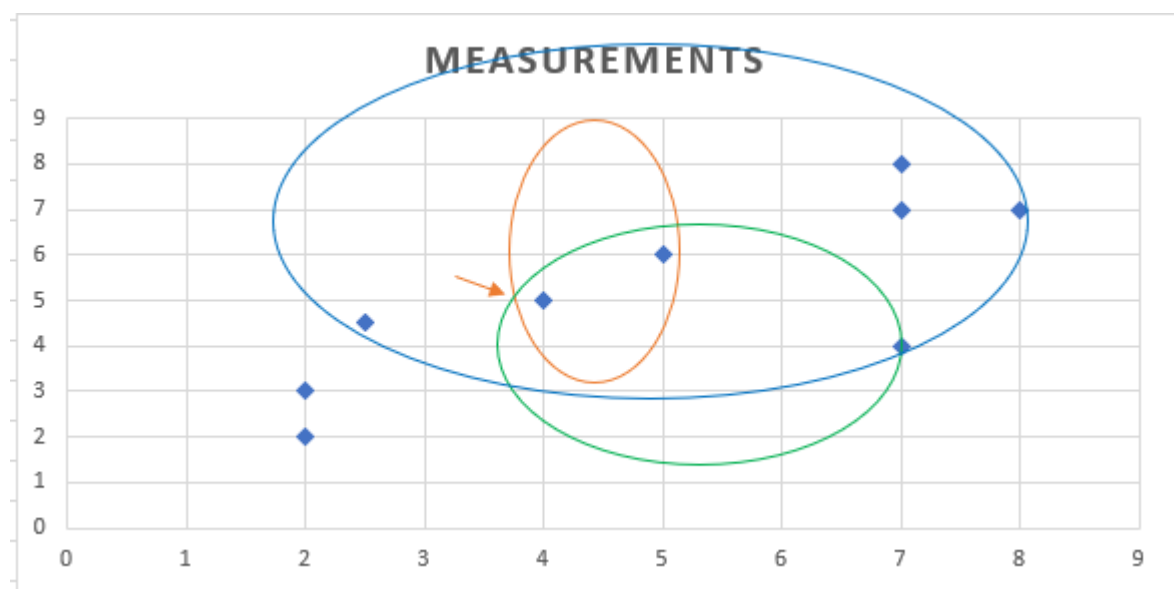
Michael and Lily should be in group Maths2 with a center in (14.5,6.5)

	Jhon	Michael	Hanna	Lily	Maths1	Maths2		Step 1
X	20	15	19	13	20	15		
Y	10	7	9	6	10	7		
DISTANCE	Jhon	Michael	Hanna	Lily				Step 2
Maths1	0	5.830952	1.414214	8.062258				
Maths2	5.830952	0	4.472136	2.236068				
					sum of "Yes"			Step 3
Maths1	Yes	No	Yes	No	2			
Maths2	No	Yes	No	Yes	2			
						Maths1		Step 4
Sum of X when Maths1 equal Yes					39	19.5 new X		
Sum of X when Maths2 equal Yes					19	9.5 new Y		
						Maths2		
Sum of Y when Maths1 equal Yes					28	14.000 new X		
Sum of Y when Maths2 equal Yes					13	6.500 new Y		

## Exercise 2 Knn

The new tissue is in range with (5,6), (7,4) and (2,4,5)

X1	X2	Y	distance	Sorting by value nearby	Is it included in your K = 3 closest neighbors?	value of Y classification
7	7	out of range	$(7-4)^2 + (7-5)^2 = 3.15$	5	NO	
7	4	out of range	$(7-4)^2 + (4-5)^2 = 2.73$	2	yes	
5	6	within range	$(5-4)^2 + (6-5)^2 = 2$	1	yes	
2.5	4.5	within range	$(2.5-4)^2 + (4.5-5)^2 = 2.81$	3	yes	
2	3		$(2-4)^2 + (3-5)^2 = 2.83$	4	NO	
2	2		$(2-4)^2 + (2-5)^2 = 3.15$	6	NO	
7	8		$(7-4)^2 + (8-5)^2 = 3.46$	8	NO	
8	7		$(8-4)^2 + (7-5)^2 = 3.41$	7	NO	
4	5?			k=1	5,6	in range
				k=2	5,6 Y 7,4	? No k pair!!
				k=3	5,6;7,4 y 2,5,4,5	in range



### Exercise 3 Naïve Bayes

What is the probability that a randomly selected person will use an iPhone?

There are 5 iPhone users out of 10, so:

$$P(\text{iPhone}) = 5/10 = 0.5$$

What is the probability that a person has a given iPhone using a Mac laptop?

$$P(\text{iPhone} \mid \text{mac}) = \frac{P(\text{mac} \cap \text{iPhone})}{P(\text{mac})}$$

First, there are 4 people who use both Mac and iPhone:

$$P(\text{mac} \cap \text{iPhone}) = 4/10 = 0.4$$

And the probability that a random person uses a mac is:  $P(\text{mac}) = 6/10 = 0.6$

So, the probability that someone uses an iPhone, since that person uses a Mac is:

$$P(\text{iPhone} \mid \text{mac}) = 0.4 / 0.6 = 0.667$$