**#1 (10 Points)**

Is the following function a proper distance function? Why? Explain your answer.



Hint: Measure the distance between (0,0), (0,1) and (1,1)

**Answer 1.**

The function given above is **NOT** a valid distance function. A valid distance function should satisfy the following properties 🡪

1. Property 1: Distance is always non-negative
2. Property 2: Commutative, distance from “A to B” is distance from “B to A”
3. Property 3: Triangle inequality holds, distance from “A to C” must be less than or equal to distance from “A to B to C”

Here, the given equation does not satisfy property 3 for example: Let us take 3 points as follows – A(0,0), B(0,1), C(1,1)

Distance of AB = (|0 - 0|+|0 – 1|) 3 = 1

Distance of BC = (|0 - 1|+|1 – 1|) 3 = 1

Distance of AC = (|0 - 1|+|0 – 1|) 3 = 8

Here, AC > AB + BC which does not satisfy property 3.

**# 2 (10 Points)**

**There are three major manufacturing companies that make a product: Manufacturers A, B, and C. Manufacture A has a 50% market share, and Manufacture B has a 30% market share. 5% of A’s products are defective, 6% of B’s products are defective, and 8% of C’s products are defective.**

1. What is the probability that a randomly selected product is defective? P(Defective)?
2. What is the probability that a randomly selected product is defective and that it came from A? P(A and Defective)?
3. What is the probability that a defective product came from B? P(B/Defective)?
4. Are these events (being defective and coming from B) independent? Why?

**Answer 2.**

1. P(Defective) = ((0.5\*0.05) + (0.30\*0.06) + (0.20\*0.08)) = 0.059 \* 100 = 5.9
2. P(A and Defective) = (0.05 \* 50) = 2.5
3. P(B|Defective) =( P(Defective|B) / P(Defective) )= 0.3050 \* 100 = 30.51
4. For events to be independent you have it should satisfu the following condition 🡪

“P(B ꓵ Defective) = P(B) \* P(Defective)”

So,

P(B) \* P(Defective) = 0.30 \* 0.059 = 0.0177

P ( B ꓵ Defective) = 0.30\*0.06 = 0.018

Since, P ( B ꓵ Defective) ≠ P (B) \* P (Defective)

So