1 (10 Points)

Measure the distance between (0, 0, 0) and (1, 1, 1) using the following distance

formula. Is the following function a proper distance function? Why? Explain

your answer.

𝒅(𝒙,𝒚) = Ʃ ((𝒙𝒊 ― 𝒀𝒊) 𝟑)

Suppose X = (0,0,0) and Y = (1,1,1) .Proper distance function must satisfied these conditions:

1. d(X,Y) > 0 for any x and y
2. d(x, y)=0 if and only if x=y
3. d(x, y)=d(y,x)

Using given distance function, 𝒅(𝒙,𝒚) = Ʃ ((𝒙𝒊 ― 𝒀𝒊) 𝟑),

d(x,y) = ( ( 0 - 1 )3 + ( 0 – 1 )3 + ( 0 – 1 )3 ) = -3

Using proper distance formula **:**

d(x,y) = √( ( 0 - 1 )2 + ( 0 - 1 )2 + ( 0 – 1 )2 ) = 1.7

we can see that d(X,Y) may be negative due to odd powers of difference of x and y values , so this fuction isn’t a proper distance function.

7. A COVID test was administered to 1,000,000 individuals. The test correctly identified 95% of those who were sick (P[positive/sick] = 0.95) but also produced a positive result for 10% of those who were not sick (P[positive/not sick] = 0.10). If the prevalence of COVID in this population is 20%, what is the probability that an individual who tested positive is actually sick? What is the probability that an individual who tested negative is actually sick?

P[sick] = 0.20 P[not sick] = 0.80

P[positive/sick] = 0.95 P[positive/not sick] = 0.10

P[positive] = P[positive/sick] \* P[sick] + P[positive/not sick] \* P[not sick] = 0.95 \* 0.20 + 0.10 \* 0.80 = 0.23

P[sick/positive] = P[positive/sick] \* P[sick] / P[positive] = 0.95 \* 0.20 / 0.23 = 0.826

P[Negative | Sick] = 0.05 (false negative rate)

P[Negative | Not Sick] = 0.90 (true negative rate)

P[Negative] = P[Negative | Sick] \* P[Sick] + P[Negative | Not Sick] \* P[Not Sick] = 0.05 \* 0.20 + 0.90 \* 0.80 = 0.77

P[Sick | Negative] = P[Negative | Sick] \* P[Sick] / P[Negative] = 0.05 \* 0.20 / 0.77 = 0.013

Therefore, the probability that an individual who tested positive is actually sick is 0.826, the probability that an individual who tested negative is actually sick is 0.013.