**CS-513 Knowledge Discovery and Data Mining-Midterm-Question 1**

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**#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.**

**Solution**: The distance between the two points can be calculated using the distance formula:

d((0,0,0),(1,1,1))= (|0 - 1|^3|+|0 -1|^3+|0-1|^3=3

To check whether the above distance function is a proper function we need to verify few conditions like:

1. d(x,y)>=0 i.e. should be positive . Since the above distance function has positive value i.e. 3 hence this condition is satisfied.
2. Identify d(x,y)=0 iff x=y . This property does not hold true for above distance function since x != y and d(x,y) !=0.
3. Symmetry d(x,y)=d(y,x). Here d(x,y)=3 and d(y,x)= (|1 - 0|^3|+|1-0|^3+|1-0|^3 = 3 Therefore this property is satisfied.
4. Triangle inequality: d(x,y)+d(y,z)>=d(x,z) for all x,y,z . Consider three points x=(0,0,0),y=(1,1,1) ,z=(2,2,2) then d(x,y)=3 d(y,z)=3 d(x,z)=24 . d(x,y)+d(y,z)!=d(x,z) therefore this property does not hold true for above distance function.

**Since the above distance function does not satisfy the property d(x,y)=0 for x=y and triangle inequality property we conclude that it is not a proper distance function.**