**Question 1:**

Consider the following three vectors u, v, w in a 6-dimensional space:

u = [1, 0.25, 0, 0, 0.5, 0]

v = [0.75, 0, 0, 0.2, 0.4, 0]

w = [0, 0.1, 0.75, 0, 0, 1]

Suppose cos (x, y) denotes the similarity of vectors x and y under the cosine similarity measure. Compute all three pairwise similarities among u, v, w.

**Answer:**

Given data is:

u = [1, 0.25, 0, 0, 0.5, 0]

v = [0.75, 0, 0, 0.2, 0.4, 0]

w = [0, 0.1, 0.75, 0, 0, 1]

|u| = √𝟏 𝟐 + 𝟎. 𝟐𝟓𝟐 + 𝟎 𝟐 + 𝟎 𝟐 + 𝟎. 𝟓 𝟐 + 𝟎 𝟐 = 𝟏. 𝟏𝟒𝟓

|v| = √𝟎. 𝟕𝟓𝟐 + 𝟎 𝟐 + 𝟎 𝟐 + 𝟎. 𝟐 𝟐 + 𝟎. 𝟒 𝟐 + 𝟎 𝟐 = 𝟎. 𝟖𝟕𝟑

|w| = √𝟎 𝟐 + 𝟎. 𝟏 𝟐 + 𝟎. 𝟕𝟓𝟐 + 𝟎 𝟐 + 𝟎 𝟐 + 𝟏 𝟐 = 𝟏. 𝟐𝟓

cos (u, v) = u\*v |𝑢|∗|𝑣| = 0.75 + 0.02 1.145 \* 0.873 → 𝜽 = 18 𝑑𝑒𝑔𝑟𝑒𝑒𝑠.

cos (v, w) = v\*w |v|∗|w| = 0 0.873\*1.25 → 𝜽 = 0 𝑑𝑒𝑔𝑟𝑒𝑒𝑠.

cos (u, w) = u\*w |𝑢|∗|w| = 0.025 1.145 \* 1.25 → 𝜽 = 89 𝑑𝑒𝑔𝑟𝑒𝑒𝑠.

**Question 2:**

Here are five vectors in a 10-dimensional space:

1111000000 0100100101 0000011110 0111111111 1011111111

Compute the Jaccard distance (not Jaccard "measure") between each pair of the vectors.

**Answer:**

Let A = 1111000000; B = 0100100101, C = 0000011110, D = 0111111111, E = 1011111111

Jaccard Distance (A, B) = 1 – (1/7) = 6/7

Jaccard Distance (A, C) = 1 – (0/8) = 1

Jaccard Distance (A, D) = 1 – (3/10) = 7/10

Jaccard Distance (A, E) = 1 – (3/10) = 7/10

Jaccard Distance (B, C) = 1 – (1/7) = 6/7

Jaccard Distance (B, D) = 1 – (4/9) = 5/9

Jaccard Distance (B, E) = 1 – (3/10) = 7/10

Jaccard Distance (C, D) = 1 – (4/9) = 5/9

Jaccard Distance (C, E) = 1 – (4/9) = 5/9

Jaccard Distance (D, E) = 1 – (8/10) = 2/10

**Question 3:**

Here are five vectors in a 10-dimensional space:

1111000000 0100100101 0000011110 0111111111 1011111111 Compute the Manhattan distance (L1 norm) between each two of these vectors.

**Answer:**

Let A = 1111000000; B = 0100100101, C = 0000011110, D = 0111111111, E = 1011111111 Manhattan distance of A, B = 6

Manhattan distance of A, C = 8

Manhattan distance of A, D = 7

Manhattan distance of A, E = 7

Manhattan distance of B, C = 6

Manhattan distance of B, D = 5

Manhattan distance of B, E = 7

Manhattan distance of C, D = 5

Manhattan distance of C, E = 5

**Question 4:** The edit distance is the minimum number of character insertions and character deletions required to turn one string into another. Compute the edit distance between each pair of the strings he, she, his, and hers.

**Answer:**

The edit distance between he and she = 1

The edit distance between he and his = 3

The edit distance between he and hers = 2

The edit distance between she and his = 4

The edit distance between she and hers = 3

The edit distance between his and hers = 3