ESS201 – C++ Programming
International Institute of Information Technology

Warm-up with C
Announcement on Sep 30, 2020 (Wednesday), at 11:59 pm IST
Submission by Oct 09, 2020 (Friday), at 11:59 pm IST, on Domjudge and LMS

Highlight:
Write a C program which does the following:

- Reads from std input, two positive real vectors
- Normalizes each vector
- Computes a select set of distance measures
- Writes in std output, the computed distances

Details:
Input: The input has to provide the following information – size of the vector, and the vector values. The input format must use -1 as a delimiter. The input sequence must be in the following order: vector-size, -1, comma-spaced values of the first vector, followed by -1, and then again comma-spaced values of the second vector, and -1. Example:
4 -1 3.4,1.3,2.51,3.24 -1 4.3,2.4,3.210,4.20 -1

Following inputs are examples of incorrect ones with missing delimiters, additional characters, space instead of comma, non-positive values in vectors:
4 -1 3.4,1.3,2.51,3.24 -1 4.3,2.4,3.210,4.20
4 3.4,1.3,2.51,3.24 4.3,2.4,3.210,4.20 -1
-1 4 -1 3.4,1.3,2.51,3.24 -1 4.3,2.4,3.210,4.20 -1
4 -1 3.4 1.3 2.51 3.24 -1 4.3 2.4 3.210 4.20 -1
4 -1 3.4,1.3,2.51,-3.24 -1 4.3,2.4,3.210,0.000 -1

If the input is incorrect, the output must be -1, without any additional punctuation marks. Example of an incorrect input and output:
$ ./a.out < 4 -1 3.4,1.3,2.51,-3.24 -1 4.3,2.4,3.210,0.000 -1
$ -1

Output: The output must provide the following distance measures between the normalized input vectors, in the following order:
Manhattan distance , Euclidean distance, Chebyshev distance, Kullback-Leibler (KL) divergence, Jensen-Shannon (JS) distance (i.e. the square root of JS divergence).

KL and JS divergences must be computed using natural logarithms. KL divergence is asymmetric, and can be symmetrised by taking the sum in either direction, i.e. KL(a,b)+KL(b,a).

The distances can be rounded off to 4 decimal points of precision, and must be printed out with comma separation.

Example of an input and output:
$ 4 -1 3.4,1.3,2.51,3.24 -1 4.3,2.4,3.210,4.20 -1
~~$ 0.0914,0.0532,0.0457,0.0168,0.0458~~
$ 0.0913,0.0531,0.0456,0.0168,0.0457

Normalization: The vectors must be normalized using the sum of the components. For vector v of size n, such that sum of components of the normalized vector is 1.0.

$$v[i] = \frac{v[i]}{s}, \text{ where } s = \sum_{i=0}^{(n-1)}$$
