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) 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

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.

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