Software/Algorithm Optimization

Software Engineer Test:

Implement a function in C or C++ or Java to perform the computation described below. **[Note: If unfamiliar with the syntax of any of the above programming languages, use a programming language of your choice, but implementation/programming logic should mimic the constraints of any of these languages].**

Then implement a program to test the function. The input data for the test program shall be provided in the file TEST.PRN, and consists of an array of floating point numbers, one per line. The output of the test program shall consist of the matrix II displayed to standard output, with one row of II being displayed per line. The test program shall provide for command line options to specify the input data file to be processed, and for the value of c and N.

Optimize the program implementation to achieve the objective in the least amount of computation possible.

Description of the Function to Implement:

Given a value c and an array of N single precision, floating point numbers pointed to by I, compute and return, the matrix II as follows:

$$k := 0.. \ c$$
$$j := 0.. \ c$$

$$II_{k,j} := \sum_{i=c}^{N-1} I_{i-k} \cdot I_{i-j}$$

Expected Results:

Given:

$$c = 4$$
$$N = 300$$

I from file TEST.PRN

$$II = \begin{bmatrix} 0.279525 & 0.276682 & 0.268098 & 0.254212 & 0.235722 \\ 0.276682 & 0.280218 & 0.277855 & 0.269717 & 0.256231 \\ 0.268098 & 0.277855 & 0.281864 & 0.279912 & 0.272113 \\ 0.254212 & 0.269717 & 0.279912 & 0.28427 & 0.282571 \\ 0.235722 & 0.256231 & 0.272113 & 0.282571 & 0.287076 \end{bmatrix}$$

The TEST.PRN is an ASCII file which contains the following set of data:

0.0532925166190
0.0516683794558
0.0476902537048
0.0413647554815
0.0329319946468
0.0228458903730
0.0117255663499
0.0002848691074
-0.0107496557757
-0.0207205601037
-0.0291095934808
-0.0355867929757
-0.0400327593088
-0.0425324626267
-0.0433433130383
-0.0428436547518
-0.0414704754949
-0.0396559350193
-0.0377718657255
-0.0360894016922
-0.0347581319511
-0.0338057726622
-0.0331562347710
-0.0326613150537
-0.0321395844221
-0.0314154438674
-0.0303520243615
-0.0288730505854
-0.0269710943103
-0.0247020889074
-0.0221683382988
-0.0194941032678
-0.0167989209294
-0.0141738941893
-0.0116654708982
-0.0092696072534
-0.0069371834397
-0.0045893550850
-0.0021395541262
0.0004824723583
0.0033096990082
0.0063245808706
0.0094567947090
0.0125931501389
0.0155984498560
0.0183437597007
0.0207367613912
0.0227479822934
0.0244269538671
0.0259037390351
0.0273736491799
0.0290660317987
0.0312010571361
0.0339411199093
0.0373451150954
0.0413341820240
0.0456762500107

```
0.0499941930175
0.0537986382842
0.0565425269306
0.0576905682683
0.0567938797176
0.0535586066544
0.0478977374732
0.0399573929608
0.0301125887781
0.0189320761710
0.0071165408008
-0.0045812586322
-0.0154430521652
-0.0248658861965
-0.0324256718159
-0.0379147380590
-0.0413487069309
-0.0429429747164
-0.0430635996163
-0.0421613194048
-0.0406996309757
-0.0390882901847
-0.0376321077347
-0.0365019105375
-0.0357304140925
-0.0352315418422
-0.0348376892507
-0.0343469046056
-0.0335705876350
-0.0323729887605
-0.0306958090514
-0.0285644773394
-0.0260762590915
-0.0233739838004
-0.0206117015332
-0.0179199818522
-0.0153782712296
-0.0130000934005
-0.0107339872047
-0.0084797972813
-0.0061165797524
-0.0035359491594
-0.0006734040799
0.0024695438333
0.0058178631589
0.0092326058075
0.0125365462154
0.0155513035133
0.0181386470795
0.0202373061329
0.0218868646771
0.0232323091477
0.0245061907917
0.0259895473719
0.0279571004212
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0.0340470597148
0.0381662361324
0.0427047684789
0.0472243055701
0.0511610209942
0.0538959056139
0.0548411570489
0.0535294860601
0.0496920049191
0.0433115623891
0.0346418991685
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-0.0104080187157
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-0.0398825220764
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-0.0387366637588
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-0.0058585838415
-0.0029708771035
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0.0067136925645
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-0.0401059724391
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-0.0351220183074
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