PROJECT 7

DYNAMIC PROGRAMMING with MATRIX CHAIN MULTIPLICATION

Using Matrix Chain Multiplication algorithm Implement a Program in any language you desire (preferably java) to implement dynamic programming,

1. The purpose of the program is to use the dynamic programming technique to do application for Matrix Chain Multiplication problem. Matrix chain multiplication is an optimization problem which can be solved using dynamic programming. Given a sequence of matrices, we have to find the most efficient way to multiply these matrices together. The problem is not actually to perform the matrix multiplications, but merely to decide which way is the best way to perform the chain multiplications.

2. The program should take the dimension of the matrices as input and the output is the m[i,j] and s[i,j] upper triangular matrices as discussed in the class together with the dimensions of all matrices.

3. (a) Display the matrix dimensions you select and the resulting m[i,j]
   and s[i,j] in upper triangular format for a matrix chain using dynamic programming.
   (b) Display the total number of scalar multiplication of the matrix chain if dynamic programming technology is **not** used.
   (c) Compare the number of scalar multiplications of (a) and (b)
   Repeat the same process for 5 sets of matrix chains.
   (You must include the one example discussed in class and in the book.)

Your program output must show proper information to be understood well by the reader/viewer.

Output

The input is [30 35 15 5 10 20 25]
********** Upper Triangular Matrices m[i,j]
0 0 0 0 0 0

0 0 15750 7875 9375 11875 15125

0 0 0 2625 4375 7125 10500

0 0 0 0 750 2500 5375

0 0 0 0 0 1000 3500

0 0 0 0 0 0 5000

0 0 0 0 0 0

********** Upper Triangular Matrices m[i,j]

********** Upper Triangular Matrices s[i,j]
0 0 0 0 0 0 0

0 0 1 1 3 3 3

0 0 0 2 3 3 3

0 0 0 0 3 3 3

0 0 0 0 0 4 5

0 0 0 0 0 0 5

0 0 0 0 0 0 0

With DP (Minimum number of multiplications) 15125
No DP (Minimum number of multiplications) 15125

(a) With DP, the calculation times: 70
(b) No DP, the calculation times: 242

The input is [11 21 31 41 13]
********** Upper Triangular Matrices m[i,j]
0 0 0 0 0

0 0 7161 21142 27005

0 0 0 26691 24986

0 0 0 0 16523

0 0 0 0 0

********** Upper Triangular Matrices m[i,j]

********** Upper Triangular Matrices s[i,j]
0 0 0 0 0

0 0 1 2 3

0 0 0 2 2

0 0 0 0 3

0 0 0 0 0

With DP (Minimum number of multiplications) 27005
No DP (Minimum number of multiplications) 27005

(a) With DP, the calculation times: 20
(b) No DP, the calculation times: 26

The input is [30 335 155 5 150 270 25]
********** Upper Triangular Matrices m[i,j]
0 0 0 0 0 0 0

0 0 1557750 309875 332375 552875 549875

0 0 0 259625 510875 914375 537750

0 0 0 0 116250 411750 255625

0 0 0 0 0 202500 236250

0 0 0 0 0 0 1012500

0 0 0 0 0 0 0

********** Upper Triangular Matrices m[i,j]

********** Upper Triangular Matrices s[i,j]
0 0 0 0 0 0 0

0 0 1 1 3 3 3

0 0 0 2 3 3 3

0 0 0 0 3 3 3

0 0 0 0 0 4 5

0 0 0 0 0 0 5

0 0 0 0 0 0 0

With DP (Minimum number of multiplications) 549875

No DP (Minimum number of multiplications)   549875

(a) With DP, the calculation times: 70
(b) No DP, the calculation times: 242

The input is [145 2 378 4 35]
********** Upper Triangular Matrices m[i,j]
0 0 0 0 0

0 0 109620 4184 13454

0 0 0 3024 3304

0 0 0 0 52920

0 0 0 0 0

********** Upper Triangular Matrices m[i,j]

********** Upper Triangular Matrices s[i,j]
0 0 0 0 0

0 0 1 1 1

0 0 0 2 3

0 0 0 0 3

0 0 0 0 0

With DP (Minimum number of multiplications) 13454
No DP (Minimum number of multiplications)   13454

(a) With DP, the calculation times: 20
(b) No DP, the calculation times: 26

The input is [3 5 15 5 1 20 5]
********** Upper Triangular Matrices m[i,j]
0 0 0 0 0 0 0

0 0 225 450 165 225 280

0 0 0 375 150 250 275

0 0 0 0 75 375 250

0 0 0 0 0 100 125

0 0 0 0 0 0 100

0 0 0 0 0 0 0

********** Upper Triangular Matrices m[i,j]

********** Upper Triangular Matrices s[i,j]
0 0 0 0 0 0 0

0 0 1 1 1 4 4

0 0 0 2 2 4 4

0 0 0 0 3 4 4

0 0 0 0 0 4 4

0 0 0 0 0 0 5

0 0 0 0 0 0 0

With DP (Minimum number of multiplications) 280
No DP (Minimum number of multiplications) 280

(a) With DP, the calculation times: 70
(b) No DP, the calculation times: 242

The input is [14 42 53 34 13 1 5 3 6 7]
********** Upper Triangular Matrices m[i,j]
0 0 0 0 0 0 0 0 0 0

0 0 31164 56392 60008 5058 5128 5115 5175 5231

0 0 0 75684 52364 4470 4680 4611 4755 4839

0 0 0 0 23426 2244 2509 2418 2595 2690

0 0 0 0 0 442 612 559 679 755

0 0 0 0 0 0 65 54 111 166

0 0 0 0 0 0 0 15 33 75

0 0 0 0 0 0 0 0 90 231

0 0 0 0 0 0 0 0 0 126

0 0 0 0 0 0 0 0 0 0

********** Upper Triangular Matrices m[i,j]

********** Upper Triangular Matrices s[i,j]
0 0 0 0 0 0 0 0 0 0

0 0 1 2 1 1 5 5 5 5

0 0 0 2 2 2 5 5 5 5

0 0 0 0 3 3 5 5 5 5

0 0 0 0 0 4 5 5 5 5

0 0 0 0 0 0 5 5 5 5

0 0 0 0 0 0 0 6 7 8

0 0 0 0 0 0 0 0 7 7

0 0 0 0 0 0 0 0 0 8

0 0 0 0 0 0 0 0 0 0

With DP (Minimum number of multiplications) 5231
No DP (Minimum number of multiplications) 5231

(a) With DP, the calculation times: 240
(b) No DP, the calculation times: 6560

Process finished with exit code 0