CS:3330, Algorithms

HW10 - Matrix Multiplication

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1 Python program

Write a python program containing a recursive function that takes as input an integer n and prints the number of different orders in which n matrices can be multipled

Python program attached with this assignment on ICON

2 Testing Python Program

Show the output of your function from Question 1 for $n = 2, 4, 6, 8, 10, 12, 12$.

If you run the python program that goes along with this assignment it will display the answers for all questions asked in the assignment. They will be stated on this document as well

Testing the python program implemented for question 1, the following was calculated with format 'size of input n : num. of different orders'. 2:1, 4:4, 6:16, 8:64, 10:256, 12:1024, 14:4096 .

3 Chained Multiplication

Suppose we want to perfrom the matrix multiplication $A_1 \times A_2 \times A_3 \times A_4 \times A_5$, where the dimensions of the matrices are -> $A_1 : 10 \times 4$, $A_2 : 4 \times 5$, $A_3 : 5 \times 20$, $A_4 : 20 \times 2$, $A_5 : 2 \times 50$.

a) Matrix M

Show the matrix M produced by Algorithm 3.6 in the textbook.

j

	x	1	2	3	4	5
	1	0	200	1200	320	1320
i	2	x	0	400	240	640
	3	x	x	0	200	700
	4	x	x	x	0	2000
	5	x	x	x	x	0

M

b) Matrix P

Show the matrix P produced by Algorithm 3.6 in the textbook.

j

i	x	1	2	3	4	5
	1	x	1	1	1	4
	2	x	x	2	2	4
	3	x	x	x	3	4
	4	x	x	x	x	4
	5	x	x	x	x	x

P

c) Optimal Output

What is the optimal number of multiplications needed?

The optimal number of multiplications needed is 1320.

d) Optimal Order

Show the optimal order for evaluating $A_1 \times A_2 \times A_3 \times A_4 \times A_5$.

The optimal order for evaluating this chained matrix multiplication is:

$$(A_1(A_2(A_3A_4)))A_5$$