

AO* Implementation on **OPTIMAL MATRIX MULTIPLICATION**

Lab 6 Report

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INTRODUCTION

The objective of this task is to solve the **Optimal Matrix Multiplication Problem**. Given a set of N matrices and their dimensions, find the least cost of multiplying the matrices.

For the given problem, the input is a list of matrix dimensions of the length N +1. The output is the least cost for the order of multiplying the matrices.

HEURISTICS

The following functions are appropriately designed to satisfy the constraints as shown below. Here d is the list of dimensions of the N matrices.

1. UNDER ESTIMATE

$$h1(d) = (d_0 * d_{N+1})$$

2. OVER ESTIMATE

$$h1(d) = (d_0 * d_1 * d_2 * * d_{N+1}) * N * N$$

OBSERVATIONS

Input	Optimal Cost	AO* Solution		States Explored	
		Under	Over	Under	Over
1 2 3 4	18	18	18	3	3
1 2 3 4 3	30	30	51	8	3
12 45 23 56 24	44004	44004	49956	8	3
10 12 14 12 42	8400	8400	14616	8	3
20 1 98 3 56	1582	1582	128184	5	3
1 2 3 4 5 6 7 8 9 10 11 12	570	570	3642	9413	11
14 58 25 32 75 69 55 23 30	218050	218050	584375	596	7
9 101 22 13 4 5 6 11 245	33652	33652	52924	226	7

We see least cost is always found when **the underestimating heuristic** is used. As expected, **overestimating heuristic** does not always guarantee optimal cost and is not admissible.

We can also observe that there is a trade-off between the number of states explored and getting the optimal solution.