CSC373 Worksheet 3 Solution

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1. **Notes:**

- Dynamic Programming
  - Is applied to optimization problems
  - Applies when the subproblems overlap
  - Uses the following sequence of steps
    1. Characterize the structure of an optimal solution
    2. Recursively define the value of an optimal solution
    3. Construct an optimal solution from computed information

- Matrix-chain Multiplication
  - is an optimization problem that can be solved using dynamic programming
  - goal is to find matrix parenthesis with fewest number of operations

    e.g

    Given chain of matrices $< A, B, C, D >$, it's fully parenthesized product is:

$$
\begin{gathered}
((AB)C)D \\
(A(BC))D \\
(AB)(CD) \\
A((BC)D) \\
A(B(CD))
\end{gathered}
$$

    * $(AB)C$ needs $(10 \times 30 \times 5) + (10 \times 5 \times 60) = 1500 + 3000 = 4500$ operations
    * $A(BC)$ needs $(30 \times 5 \times 60) + (10 \times 30 \times 60) = 27000$ operations

Thus, $(AB)C$ performs more efficiently than $A(BC)$.

- Is stated as: given a chain $< A_1, A_2, ..., A_n >$ of n matrices, where for $i = 1, 2, ..., n$ matrix A_i has dimension $p_{i-1} \times p_i$, fully parenthesize the product $A_1 A_2 ... A_n$ in a way that minimizes the number of scalar multiplications.