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Experiment No.	5

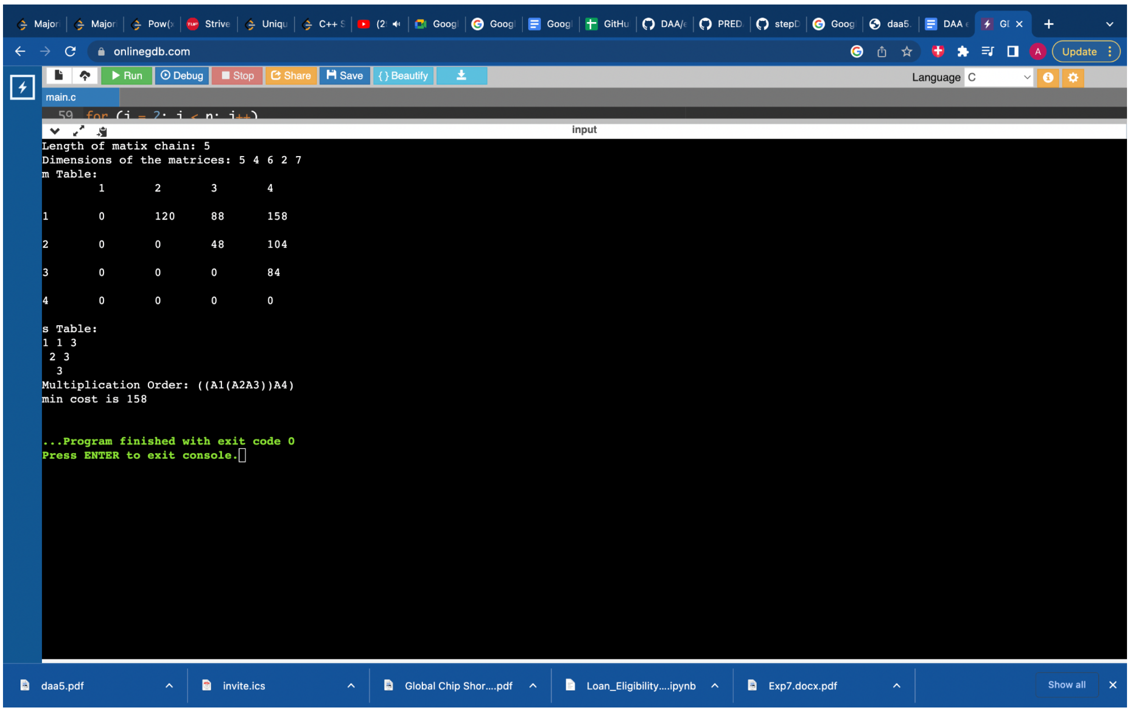
AIM:	Dynamic Programming - Matrix Chain Multiplication
Program	
PROBLEM STATEMENT:	Apply the concept of dynamic programming to solve the problem of finding the minimum cost i.e. multiplications required to perform Matrix Chain Multiplications
PROGRAMME	(code below)

```
#include <limits.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
void print_parentheses(int s[][5], int i, int j)
{
if (i == j)
{
printf("A%d", i);
return;
}
printf("(");
print_parentheses(s, i, s[i][j]);
print_parentheses(s, s[i][j] + 1, j);
printf(")");
}
int matrixmin(int p[], int n)
{
int m[n][n];
int s[n][n];
memset(m, 0, sizeof(m[0][0]) * n * n);
int i, j, k, L, q;
for (L = 2; L < n; L++)
{
for (i = 1; i < n - L + 1; i++)
{
j = i + L - 1;
m[i][j] = INT_MAX;
for (k = i; k <= j - 1; k++)
{
q = m[i][k] + m[k + 1][j] + p[i - 1] * p[k] * p[j];
if (q < m[i][j])
```

	`` { m[i][j] = q; s[i][j] = k; } } } } printf("m Table:\n"); for (int i = 1; i < n; i++) { printf("\t%d", i); } printf("\n\n"); for (i = 1; i < n; i++) { for (j = 1; j < n; j++) { if (j == 1) printf("%d", i); printf("\t%d", m[i][j]); } printf("\n\n"); } printf("s Table:\n"); for (i = 1; i < n - 1; i++) { for (j = 2; j < n; j++) { if (i < j) { printf("%d ", s[i][j]); } else { printf(" "); } } printf("\n"); } printf("Multiplication Order: "); print_parentheses(s, 1, n - 1); printf("\n"); return m[1][n - 1]; } int main() { printf("Length of matix chain: "); ```

	`` int n; scanf("%d", &n); int arr[n]; printf("Dimensions of the matrices: "); for (int i = 0; i < n; i++) { scanf("%d", &arr[i]); } printf("min cost is %d\n", matrixmin(arr, n)); return 0; } ```

Theory: **Matrix Chain Multiplication can be solved using dynamic programming. We can define the minimum number of scalar multiplications needed to iteratively compute the product of a chain of matrices. We start with sub chains of length 1 and then compute the minimum cost for sub chains of increasing length until we have the minimum cost for the entire chain. The time complexity of this algorithm is O(n^3), where n is the number of matrices in the chain. Algorithm: 1. Define the subproblem: Find the minimum number of scalar multiplications needed to compute the product of a chain of matrices. 2. Find the recurrence relation: Let M[i,j] be the minimum number of scalar multiplications needed to compute the product of the chain of matrices from matrix i to matrix j. We can define M[i,j] recursively as follows: M[i,j] = min(M[i,k] + M[k+1,j] + a[i-1] x a[k] x a[j]) for i ≤ k < j 3. Initialize the base case: M[i,i] = 0 for 1 ≤ i ≤ n, where n is the number of matrices in the chain. 4. Solve the subproblems: Compute the minimum cost for subchains of increasing length until we have the minimum cost for the entire chain. 5. Return the final answer: The minimum cost for the entire chain is stored in M[1,n], where n is the number of matrices in the chain.**

CONCLUSION:	

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Run
Debug
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{ } Beautify
Language C
main.c
input
Length of matix chain: 5
Dimensions of the matrices: 5 4 6 2 7
m Table:
1 2 3 4
1 0 120 88 158
2 0 0 48 104
3 0 0 0 84
4 0 0 0 0
s Table:
1 1 3
2 3
3
Multiplication Order: ((A1(A2A3))A4)
min cost is 158
...Program finished with exit code 0
Press ENTER to exit console.
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Global Chip Shor....pdf
Loan_Eligibility....ipynb
Exp7.docx.pdf
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