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Experiment No.	5

AIM:	Matrix Chain Multiplication
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
ALGORITHM/ 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. **<u>Algorithm</u>**: 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 $i \leq k < j$ 3. Initialize the base case: M[i,i] = 0 for $1 \leq i \leq n$, 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.

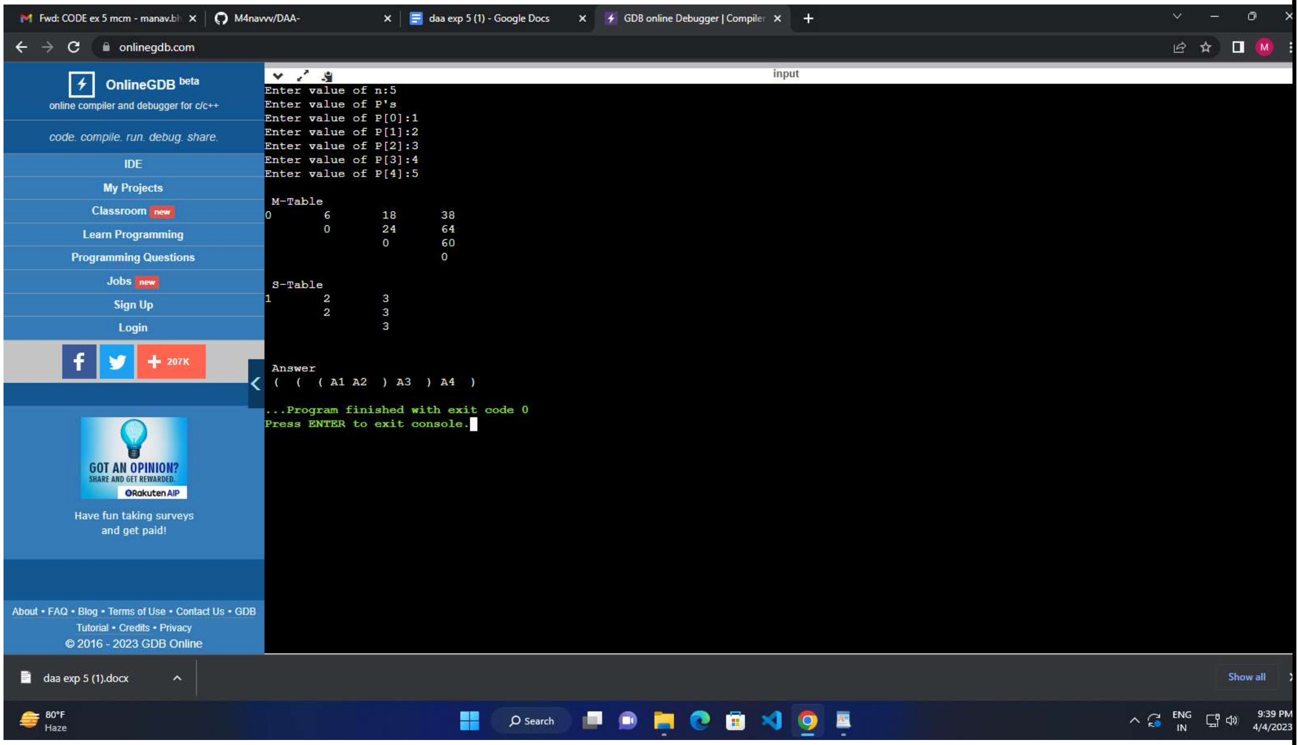
PROGRAM:

```
 #include<stdio.h>
#include<conio.h>
void optimal(int s[10][10],int i,int j);
void mcp(int n, int p[10])
{
    int k,i,j,m[10][10],temp,s[10][10];
    for(j=1;j<=n;j++)
    {
        for(i=n;i>=1;i--)
        {
            if(i==j)
            {
                m[i][j]=0;
            }
            else if(i<j)
            {
                m[i][j]=9999;
                for(k=i;k<=j-1;k++)
                {
                    temp=m[i][k]+m[k+1][j]+(p[i-1]*p[j]*p[k]);
                    if(temp<m[i][j])
                    {
                        m[i][j]=temp;
                        s[i][j]=k;
                    }
                }
            }
        }
    }
    printf("\n M-Table \n");
    for(i=1;i<n;i++)
    {
        for(j=1;j<n;j++)
        {
            if(i>j)
            {
                printf("\t");
            }
            else
            {
                printf("%d\t",m[i][j]);
            }
        }
        printf("\n");
    }
    printf("\n S-Table \n");
    for(i=1;i<n;i++)
    {
        for(j=2;j<n;j++)
        {
            if(i>=j)
            {
                printf("\t");
            }
            else
            {
                printf("%d\t",s[i][j]);
            }
        }
        printf("\n");
    }
    printf("\n Answer \n");
    optimal(s,1,n-1);
}

void optimal(int s[10][10],int i,int j)
{
    if(i==j)
    {
        printf("A%d ",i);
    }
    else
    {
        printf(" ( ");
        optimal(s,i,s[i][j]);
        optimal(s,s[i][j]+1,j);
        printf(" ) ");
    }
}

void main()
{
    int n,p[10],i;
    printf("Enter value of n:");
    scanf("%d",&n);
    printf("Enter value of P's\n");
    for(i=0;i<n;i++)
    {
        printf("Enter value of P[%d]:",i);
        scanf("%d",&p[i]);
    }
    mcp(n,p);
    getch();
}
```

RESULT:


Fwd: CODE ex 5 mcm - manav.bh
M4navvv/DAA-
daa exp 5 (1) - Google Docs
GDB online Debugger | Compiler
onlinegdb.com
OnlineGDB beta
online compiler and debugger for c/c++
code. compile. run. debug. share.
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input
daa exp 5 (1).docx
Show all
80°F
Haze
Search
ENG
IN
9:39 PM
4/4/2023

```
Enter value of n:5
Enter value of P's
Enter value of P[0]:1
Enter value of P[1]:2
Enter value of P[2]:3
Enter value of P[3]:4
Enter value of P[4]:5

 M-Table
0       6       18      38
        0       24      64
                0       60
                        0


 S-Table
1       2       3
        2       3
                3



 Answer
 (  (  ( A1 A2  ) A3  ) A4  )

...Program finished with exit code 0
Press ENTER to exit console.
```

CONCLUSION: Successfully carried out matrix chain multiplication and displayed the parenthesizing as well