CHANDIGARH UNIVERSITY

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UNIVERSITY INSTITUTE OF ENGINEERING

Department of Computer Science & Engineering

Subject Name: DAA Lab

Subject Code: 20ITP-312

Submitted to:

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Group: B

Worksheet Experiment – 2.1

Name: Ruchika Raj **UID: 20BCS9285**
Branch: BE-CSE **Section/Group: 20BCS_WM-615-B**
Semester: 5th **Subject: DAA Lab**

1. Aim/Overview of the practical:

Code and analyze to find an optimal solution to matrix chain multiplication using dynamic programming.

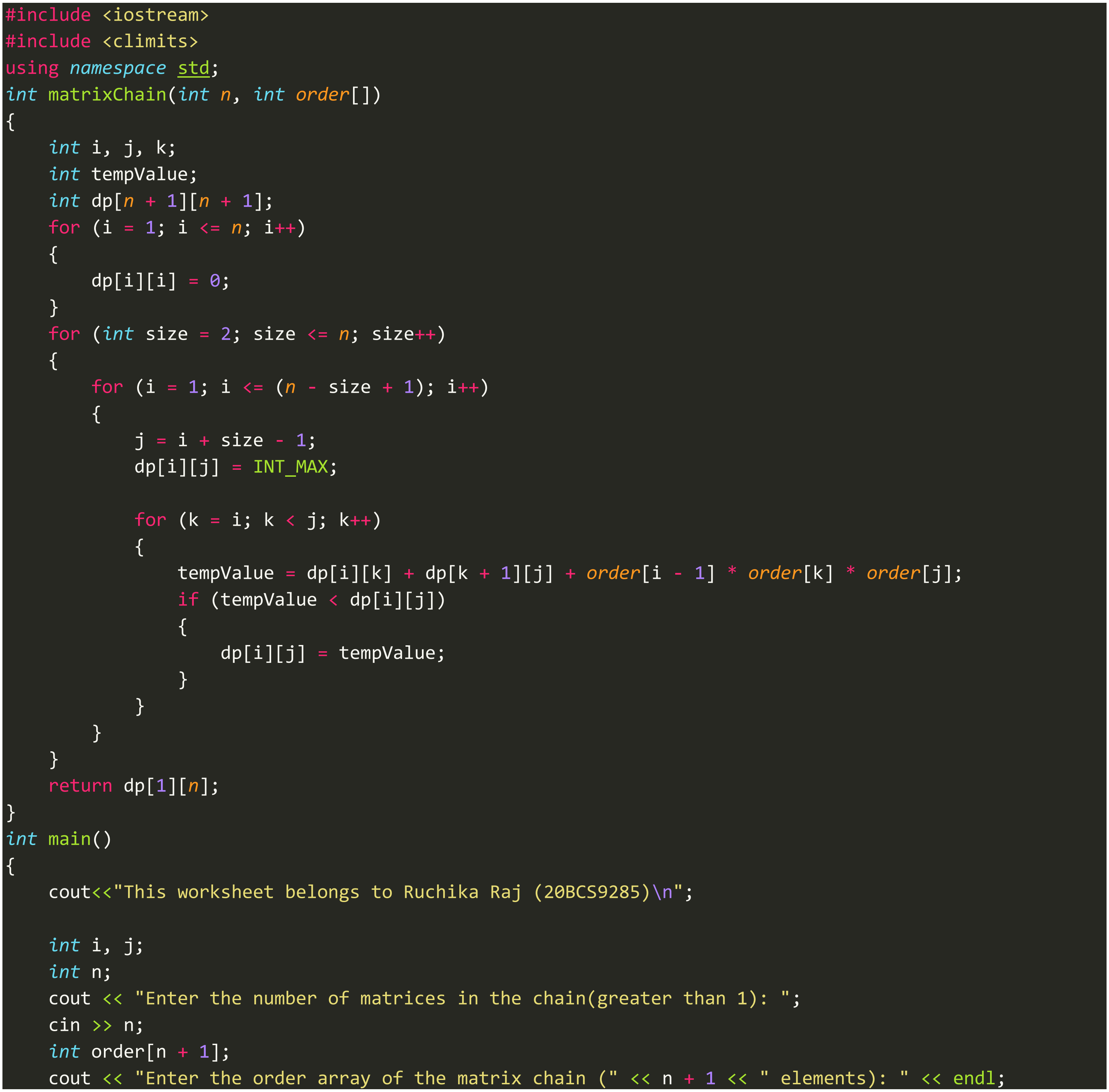
2. Task to be done/ Which logistics used:

Find the minimum multiplication operations required for multiply n matrices.

3. Algorithm/Flowchart:

1. Build a matrix dp[][] of size N*N for memoization purposes.
2. Use the same recursive call as done in the above approach:
3. When we find a range (i, j) for which the value is already calculated, return the minimum value for that range (i.e., dp[i][j]).
4. Otherwise, perform the recursive calls as mentioned earlier.
5. The value stored at dp[0][N-1] is the required answer.

4. Steps for experiment/practical/Code:

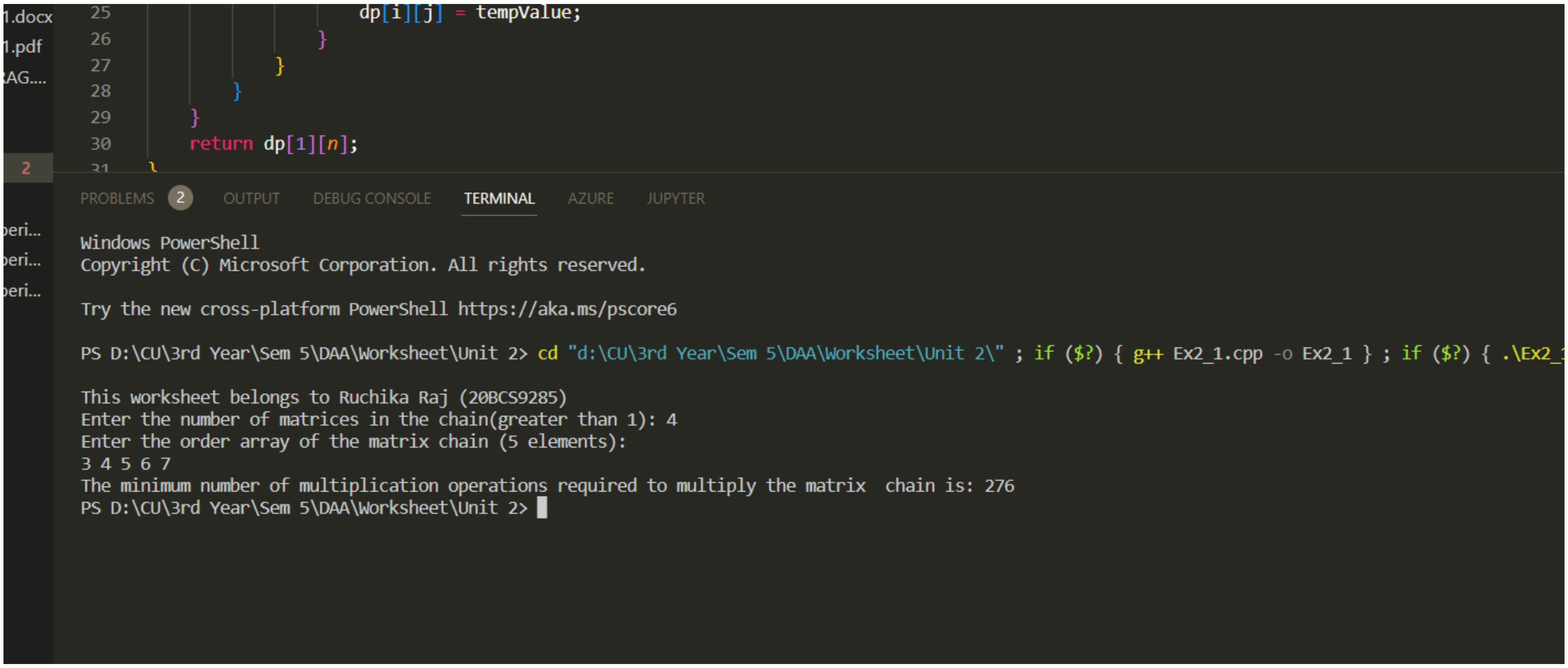


```
#include <iostream>
#include <climits>
using namespace std;
int matrixChain(int n, int order[])
{
    int i, j, k;
    int tempValue;
    int dp[n + 1][n + 1];
    for (i = 1; i <= n; i++)
    {
        dp[i][i] = 0;
    }
    for (int size = 2; size <= n; size++)
    {
        for (i = 1; i <= (n - size + 1); i++)
        {
            j = i + size - 1;
            dp[i][j] = INT_MAX;

            for (k = i; k < j; k++)
            {
                tempValue = dp[i][k] + dp[k + 1][j] + order[i - 1] * order[k] * order[j];
                if (tempValue < dp[i][j])
                {
                    dp[i][j] = tempValue;
                }
            }
        }
    }
    return dp[1][n];
}
int main()
{
    cout<<"This worksheet belongs to Ruchika Raj (20BCS9285)\n";

    int i, j;
    int n;
    cout << "Enter the number of matrices in the chain(greater than 1): ";
    cin >> n;
    int order[n + 1];
    cout << "Enter the order array of the matrix chain (" << n + 1 << " elements): " << endl;
    for (i = 0; i <= n; i++)
    {
        cin >> order[i];
    }
    cout << "The minimum number of multiplication operations required to multiply the matrix  chain
is: " << matrixChain(n, order);
    cout << endl;
    return 0;
}
```

5. Observations/Discussions/ Complexity Analysis:

Time Complexity: O(n^3)

6. Result/Output/Writing Summary:



```
                        dp[i][j] = tempValue;
                    }
                }
            }
        }
        return dp[1][n];
```

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\CU\3rd Year\Sem 5\DAA\Worksheet\Unit 2> cd "d:\CU\3rd Year\Sem 5\DAA\Worksheet\Unit 2\" ; if ($?) { g++ Ex2_1.cpp -o Ex2_1 } ; if ($?) { .\Ex2_

This worksheet belongs to Ruchika Raj (20BCS9285)
Enter the number of matrices in the chain(greater than 1): 4
Enter the order array of the matrix chain (5 elements):
3 4 5 6 7
The minimum number of multiplication operations required to multiply the matrix  chain is: 276
PS D:\CU\3rd Year\Sem 5\DAA\Worksheet\Unit 2> 
```

Learning Outcomes:-

1. Create a program keeping in mind the time complexity

2. Create a program keeping in mind the space complexity

3. Steps to make optimal algorithm

4. Learnt about matrix application using dynamic programming.