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BATCH: A

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHM

SUBJECT CODE: CS 351

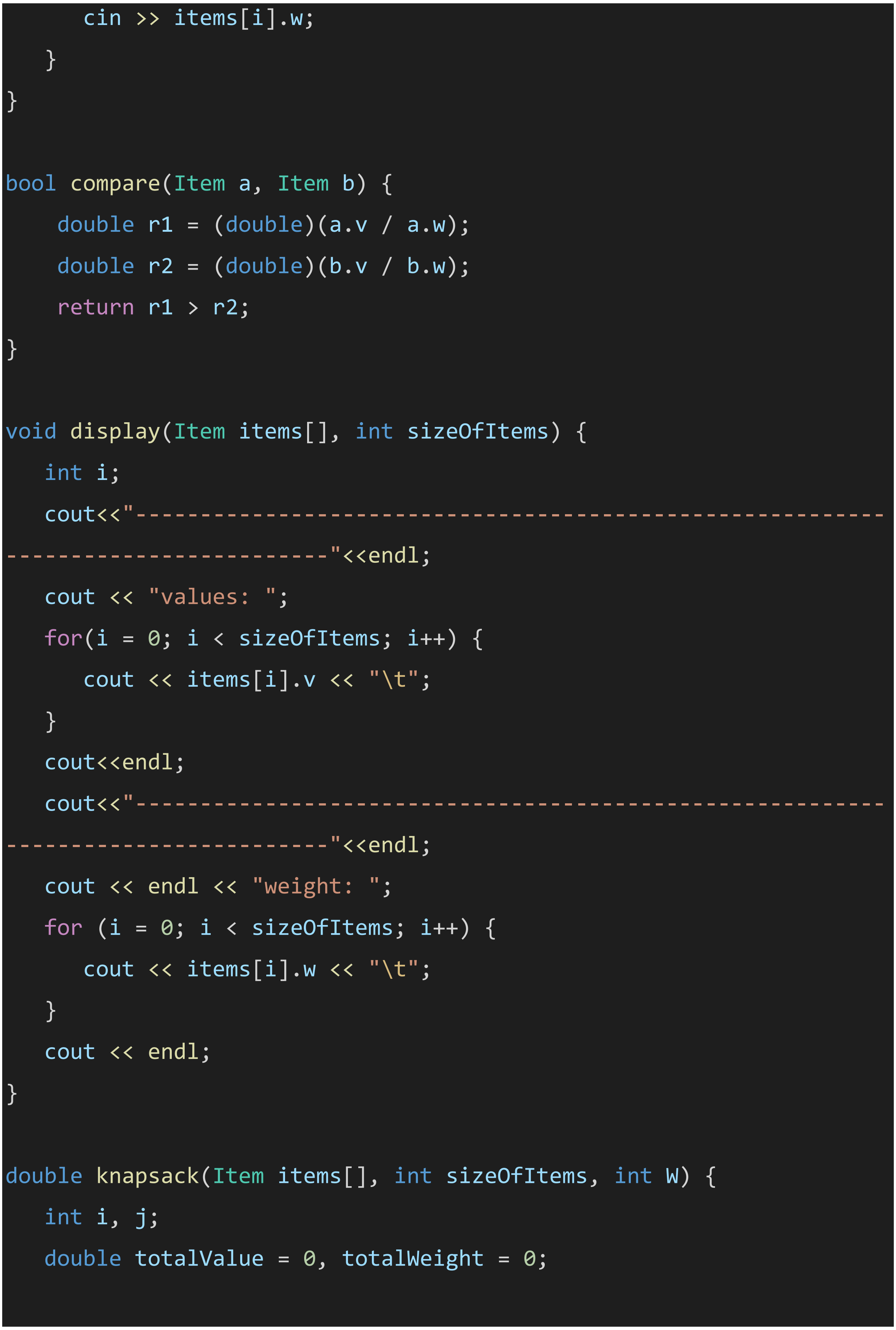
PRACTICAL-1

AIM:

Implement Knapsack Problem using Greedy Approach

PROGRAM CODE:

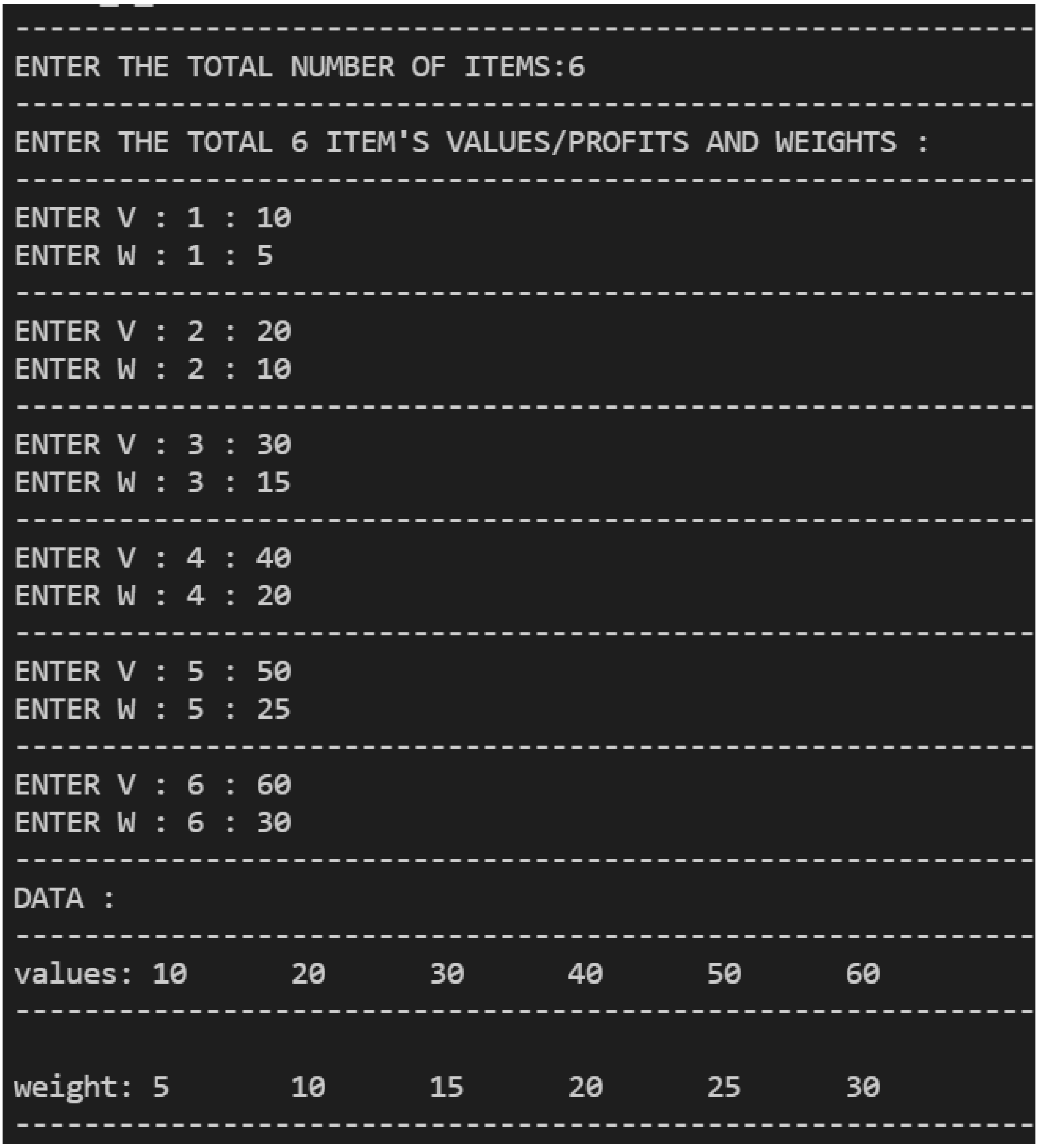
```
#include <iostream>
#include <bits/stdc++.h>
using namespace std;

typedef struct {
   double v;
   double w;
} Item;

void input(Item items[],int sizeOfItems) {
   cout<<"----------------------------------------------------------
-------------------------"<<endl;
   cout << "ENTER THE TOTAL "<< sizeOfItems <<" ITEM'S
VALUES/PROFITS AND WEIGHTS : " <<endl;
   for(int i = 0; i < sizeOfItems; i++) {
      cout<<"-------------------------------------------------------
----------------------------"<<endl;
      cout << "ENTER V : "<<i+1<<" : ";
      cin >> items[i].v;
      cout << "ENTER W : "<< i+1 << " : ";
```



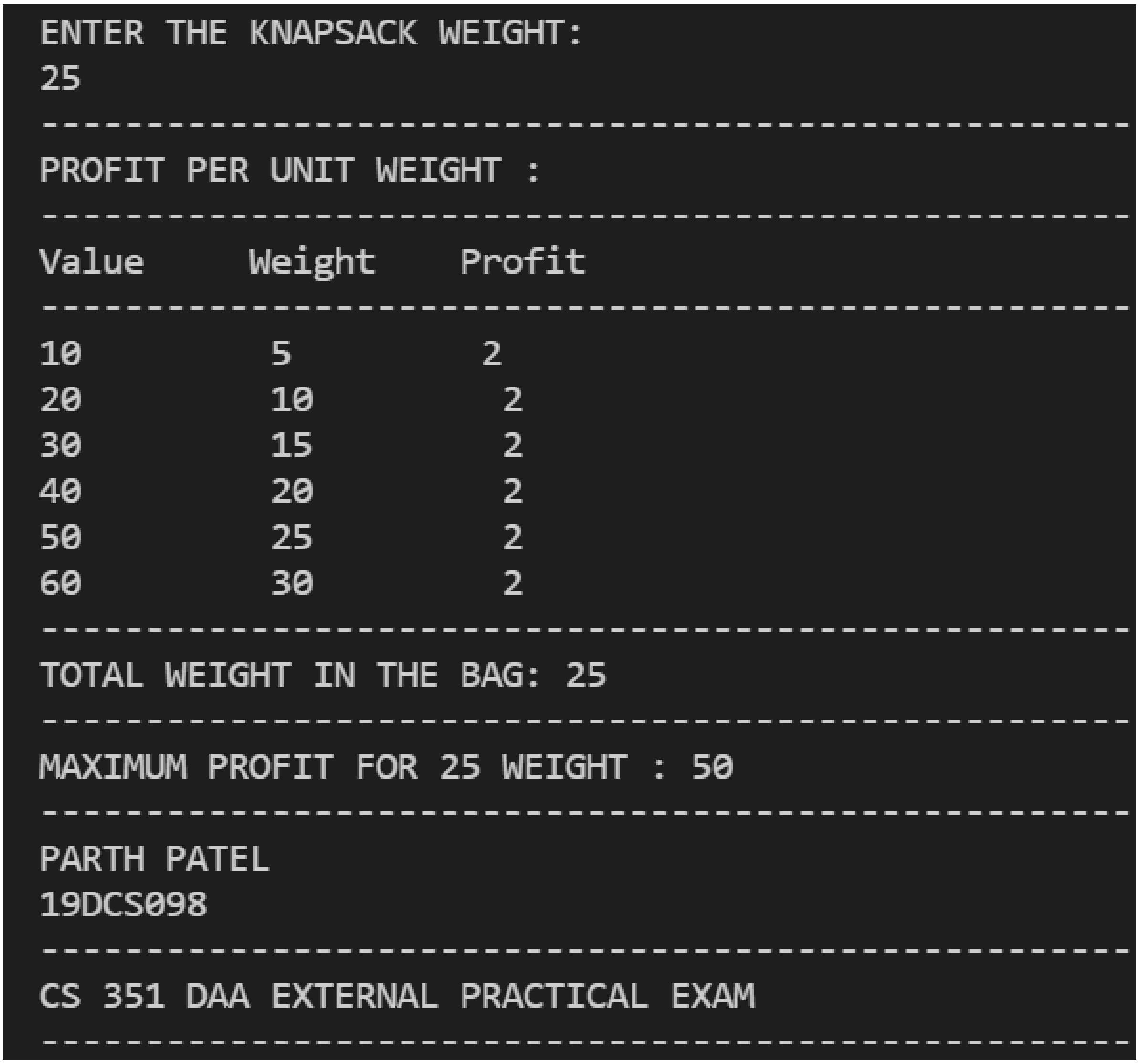
```
      cin >> items[i].w;
   }
}

bool compare(Item a, Item b) {
    double r1 = (double)(a.v / a.w);
    double r2 = (double)(b.v / b.w);
    return r1 > r2;
}

void display(Item items[], int sizeOfItems) {
   int i;
   cout<<"----------------------------------------------------------
-------------------------"<<endl;
   cout << "values: ";
   for(i = 0; i < sizeOfItems; i++) {
      cout << items[i].v << "\t";
   }
   cout<<endl;
   cout<<"----------------------------------------------------------
-------------------------"<<endl;
   cout << endl << "weight: ";
   for (i = 0; i < sizeOfItems; i++) {
      cout << items[i].w << "\t";
   }
   cout << endl;
}

double knapsack(Item items[], int sizeOfItems, int W) {
   int i, j;
   double totalValue = 0, totalWeight = 0;
   cout<<"----------------------------------------------------------
-------------------------"<<endl;
   cout<<"PROFIT PER UNIT WEIGHT :\n";
   cout<<"----------------------------------------------------------
-------------------------"<<endl;
   cout<<"Value     Weight    Profit\n";
   cout<<"----------------------------------------------------------
-------------------------"<<endl;
   for (int i = 0; i < sizeOfItems; i++)
   {
      cout << items[i].v << "          " << items[i].w << "          "
         << ((double)items[i].v / items[i].w) << endl;
   }
   sort(items, items+sizeOfItems, compare);
   for(i=0; i<sizeOfItems; i++) {
      if(totalWeight + items[i].w<= W) {
         totalValue += items[i].v ;
         totalWeight += items[i].w;
      } else {
         int wt = W-totalWeight;
         totalValue += items[i].v*((double)wt / items[i].w);
         totalWeight += wt;
         break;
      }
   }
   cout<<"----------------------------------------------------------
-------------------------"<<endl;
   cout << "TOTAL WEIGHT IN THE BAG: " << totalWeight<<endl;
   return totalValue;
}
int main() {
   int W,n;
```

```
    cout<<"-----------------------------------------------------------------------------------"<<endl;
    cout<<"ENTER THE TOTAL NUMBER OF ITEMS:";
    cin>>n;
    Item items[n];
    input(items, n);
    cout<<"-----------------------------------------------------------------------------------"<<endl;
    cout << "DATA :\n";
    display(items,n);
    cout<<"-----------------------------------------------------------------------------------"<<endl;
    cout<< "ENTER THE KNAPSACK WEIGHT: \n";
    cin >> W;
    double mxVal = knapsack(items, n, W);
    cout<<"-----------------------------------------------------------------------------------"<<endl;
    cout << "MAXIMUM PROFIT FOR "<< W <<" WEIGHT : "<< mxVal;
    cout<<endl;
    cout<<"-----------------------------------------------------------------------------------"<<endl;
    cout<<"PARTH PATEL\n19DCS098"<<endl;
    cout<<"-----------------------------------------------------------------------------------"<<endl;
    cout<<"CS 351 DAA EXTERNAL PRACTICAL EXAM"<<endl;
    cout<<"-----------------------------------------------------------------------------------"<<endl;
    return 0;
}
```

OUTPUT:



```
-----------------------------------------------------------
ENTER THE TOTAL NUMBER OF ITEMS:6
-----------------------------------------------------------
ENTER THE TOTAL 6 ITEM'S VALUES/PROFITS AND WEIGHTS :
-----------------------------------------------------------
ENTER V : 1 : 10
ENTER W : 1 : 5
-----------------------------------------------------------
ENTER V : 2 : 20
ENTER W : 2 : 10
-----------------------------------------------------------
ENTER V : 3 : 30
ENTER W : 3 : 15
-----------------------------------------------------------
ENTER V : 4 : 40
ENTER W : 4 : 20
-----------------------------------------------------------
ENTER V : 5 : 50
ENTER W : 5 : 25
-----------------------------------------------------------
ENTER V : 6 : 60
ENTER W : 6 : 30
-----------------------------------------------------------
DATA :
-----------------------------------------------------------
values: 10      20      30      40      50      60
-----------------------------------------------------------


weight: 5       10      15      20      25      30
-----------------------------------------------------------
```



```
ENTER THE KNAPSACK WEIGHT:
25
----------------------------------------------------
PROFIT PER UNIT WEIGHT :
----------------------------------------------------
Value     Weight    Profit
----------------------------------------------------
10         5         2
20         10         2
30         15         2
40         20         2
50         25         2
60         30         2
----------------------------------------------------
TOTAL WEIGHT IN THE BAG: 25
----------------------------------------------------
MAXIMUM PROFIT FOR 25 WEIGHT : 50
----------------------------------------------------
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----------------------------------------------------
```

PRACTICAL-2

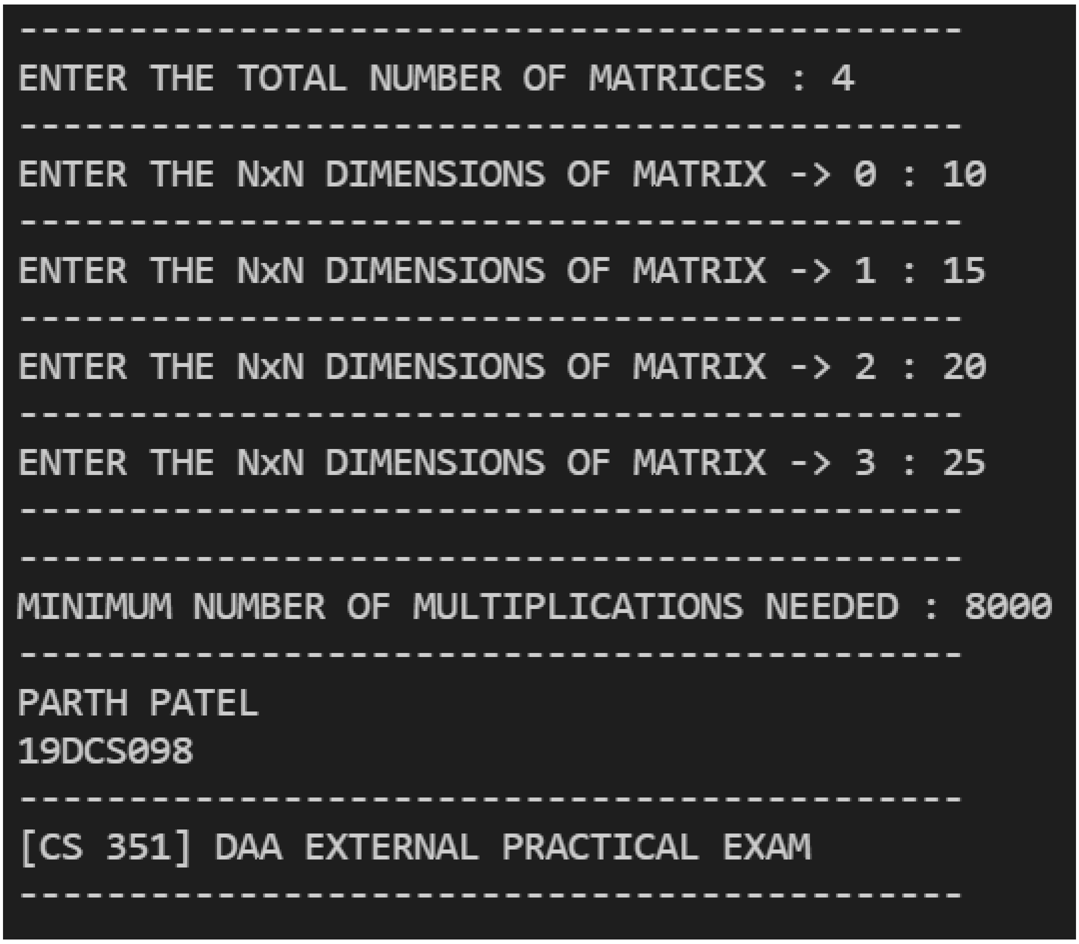
AIM:

Implement Matrix Chain Multiplication using Dynamic Programming

PROGRAM CODE:

```
#include <bits/stdc++.h>
using namespace std;
int MatrixChainMultiplication(int product[], int n)
{
    int matrix[n][n];
    int i, j, k, L, q;
    for (i = 1; i < n; i++)
        matrix[i][i] = 0;

    for (L = 2; L < n; L++)
    {
        for (i = 1; i < n - L + 1; i++)
        {
            j = i + L - 1;
            matrix[i][j] = INT_MAX;
            for (k = i; k <= j - 1; k++)
            {

                q = matrix[i][k] + matrix[k + 1][j] +
                    product[i - 1] * product[k] * product[j];
                if (q < matrix[i][j])
                    matrix[i][j] = q;
            }
        }
    }
    return matrix[1][n - 1];
}
int main()
{
    int n;

    cout<<"-------------------------------------------"<<endl;
    cout << "ENTER THE TOTAL NUMBER OF MATRICES : ";
    cin >> n;
    int arr[n];
    cout<<"-------------------------------------------"<<endl;
    for (int i = 0; i < n; i++)
    {
        cout << "ENTER THE NxN DIMENSIONS OF MATRIX -> " << i << " :
";

        cin >> arr[i];
        cout<<"-------------------------------------------"<<endl;
    }
    int length = sizeof(arr) / sizeof(arr[0]);
    cout<<"-------------------------------------------"<<endl;
    cout << "MINIMUM NUMBER OF MULTIPLICATIONS NEEDED : " <<
MatrixChainMultiplication(arr, length) << endl;
    cout<<"-------------------------------------------"<<endl;
    cout << "PARTH PATEL\n19DCS098" << endl;
    cout<<"-------------------------------------------"<<endl;
    cout<<"[CS 351] DAA EXTERNAL PRACTICAL EXAM"<<endl;
    cout<<"-------------------------------------------"<<endl;
    return 0;
}
```

OUTPUT:



```
-------------------------------------------
ENTER THE TOTAL NUMBER OF MATRICES : 4
-------------------------------------------
ENTER THE NxN DIMENSIONS OF MATRIX -> 0 : 10
-------------------------------------------
ENTER THE NxN DIMENSIONS OF MATRIX -> 1 : 15
-------------------------------------------
ENTER THE NxN DIMENSIONS OF MATRIX -> 2 : 20
-------------------------------------------
ENTER THE NxN DIMENSIONS OF MATRIX -> 3 : 25
-------------------------------------------

-------------------------------------------
MINIMUM NUMBER OF MULTIPLICATIONS NEEDED : 8000
-------------------------------------------
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-------------------------------------------
[CS 351] DAA EXTERNAL PRACTICAL EXAM
-------------------------------------------
```