Ravi sajjanar

1BM19CS127

PROGRAM 12: Knapsack problem

Implement 0/1 Knapsack problem using dynamic programming.

AIM: Implement O/I Knapsack problem using dynamic programming.

ALGORITHM : knapsack(w[1…n],p[1…n],n,m)

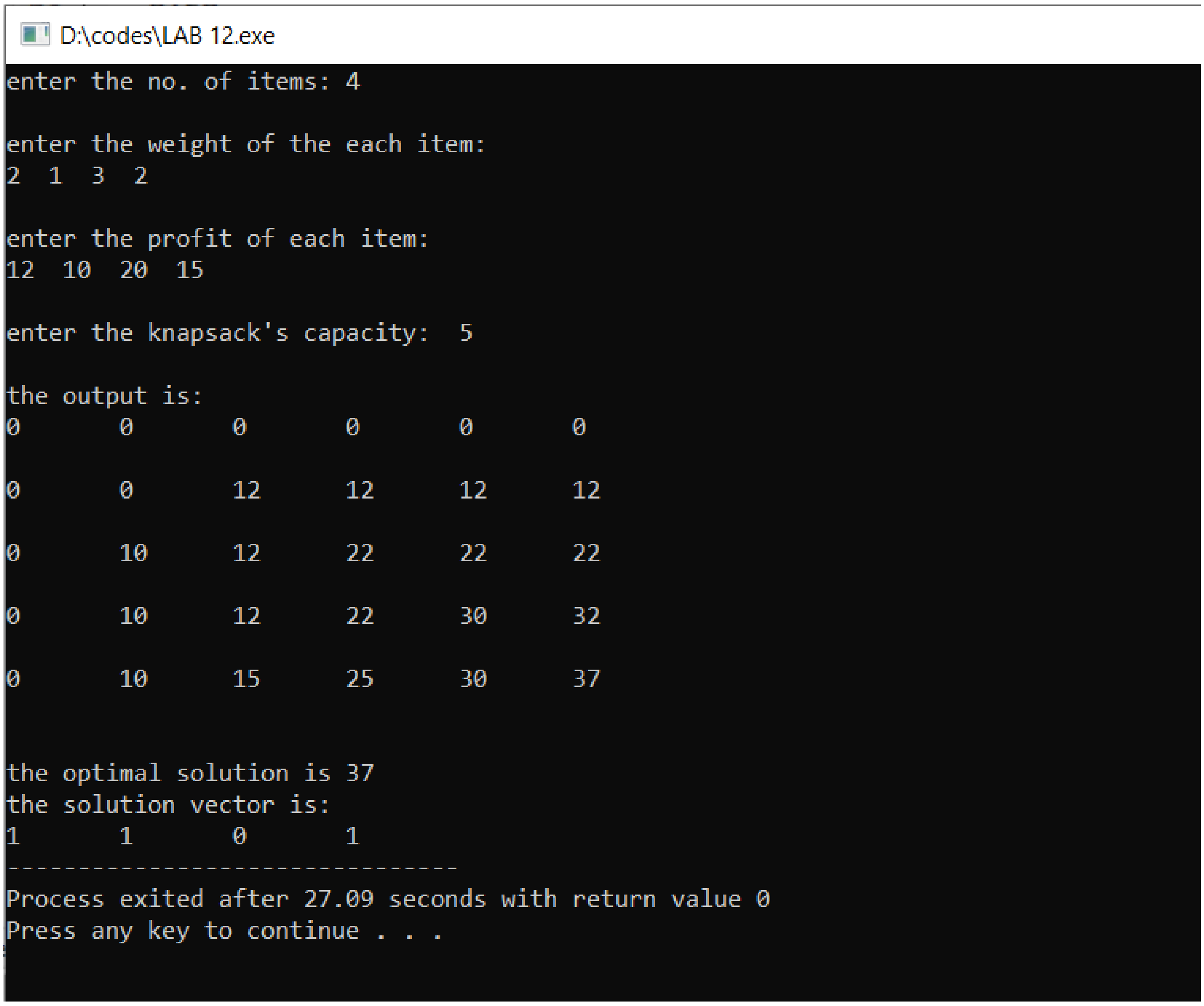
```
//To find the optimal solution for the Knapsack problem using dynamic programming
// Input: n-number of objects to be selected
//          m-maximum capacity of the Knapsack
//          An array w[1….n] contains weights of all objects
//          An array p[1….n] contains profits of all objects
// Output :A matrix  v[0….n,0….m] contains the optimal solution for the number of  objects selected with
//            specified remaining capacity
for i□0 to n do
   for j□0 to m do
       if i=0 or j=0
           v[i,j]=0
       else if j-w[i]<0
           v[i,j]=v[i-1,j]
       else
           v[i,j]=max(v[i-1,j],v[i-1,j-w[i]+p[i])
       end if
   end for
end for
write 'the output is'
for i□0 to n do
   for j□0 to m do
       write v[i,j]
   end for
end for
write 'the optimal solution is',v[n,m]
write 'solution vector is'
for i□n downto 1 do
    if  v[i,m]!=v[i-1,m]
       x[i]□1
       m□m-w[i]
    else
       x[i]□0
    end if
end for
for i□1 to n do
     write x[i]
end for
return
```

Program:

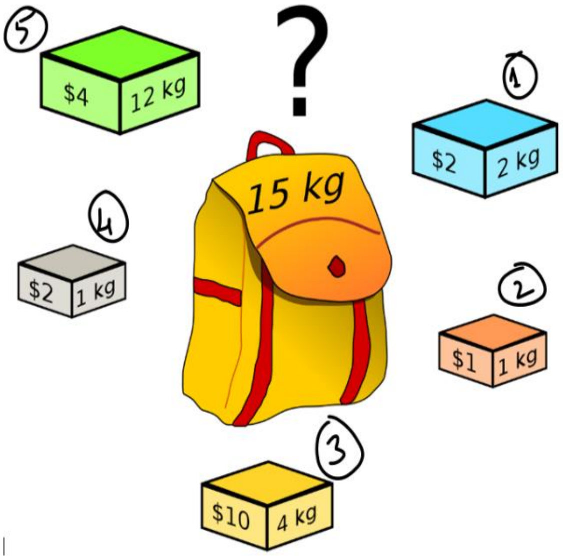
```
#include<stdio.h>
#include<conio.h>
void knapsack();
int max(int,int);
int i,j,n,m,p[10],w[10],v[10][10];
void main()
{
 clrscr();
 printf("\nenter the no. of items:\t");
 scanf("%d",&n);
 printf("\nenter the weight of the each item:\n");
 for(i=1;i<=n;i++)
 {
  scanf("%d",&w[i]);
 }
 printf("\nenter the profit of each item:\n");
 for(i=1;i<=n;i++)
 {
  scanf("%d",&p[i]);
 }
 printf("\nenter the knapsack's capacity:\t");
 scanf("%d",&m);
 knapsack();
 getch();
}

void knapsack()
{
 int x[10];
 for(i=0;i<=n;i++)
 {
  for(j=0;j<=m;j++)
  {
   if(i==0||j==0)
   {
    v[i][j]=0;
   }
   else if(j-w[i]<0)
   {
    v[i][j]=v[i-1][j];
   }
   else
   {
    v[i][j]=max(v[i-1][j],v[i-1][j-w[i]]+p[i]);
   }
  }
 }
 printf("\nthe output is:\n");
 for(i=0;i<=n;i++)
 {
  for(j=0;j<=m;j++)
  {
   printf("%d\t",v[i][j]);
  }
  printf("\n\n");
 }
 printf("\nthe optimal solution is %d",v[n][m]);
 printf("\nthe solution vector is:\n");
 for(i=n;i>=1;i--)
 {
  if(v[i][m]!=v[i-1][m])
  {
   x[i]=1;
   m=m-w[i];
  }
  else
  {
   x[i]=0;
  }
 }
 for(i=1;i<=n;i++)
 {
  printf("%d\t",x[i]);
 }
}

int max(int x,int y)
{
 if(x>y)
 {
  return x;
 }
 else
 {
  return y;
 }
}
```

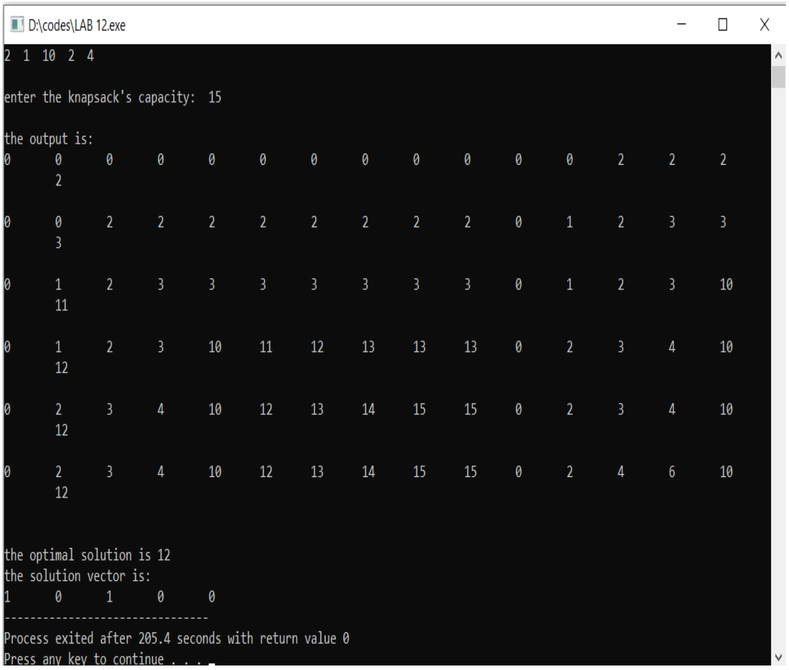
Output:

```
Enter the no. of items:  4

Enter the weight of each item:
2    1     3    2

Enter the profit of the each item:
12   10   20   15

Enter the Knapsack’s capacity:  5

The output is:
0     0     0    0     0      0
0     0   12   12   12   12
0   10   12   22   22   22
0   10   12   22   30   32
0   10   15   25   30   37
The optimal solution is:   37

The solution vector is:
1   1   0   1
```



```
enter the no. of items: 4

enter the weight of the each item:
2  1  3  2

enter the profit of each item:
12  10  20  15

enter the knapsack's capacity:  5

the output is:
0       0       0       0       0       0

0       0       12      12      12      12

0       10      12      22      22      22

0       10      12      22      30      32

0       10      15      25      30      37


the optimal solution is 37
the solution vector is:
1       1       0       1
--------------------------------
Process exited after 27.09 seconds with return value 0
Press any key to continue . . .
```





```
2  1  10  2  4

enter the knapsack's capacity:  15

the output is:
0       0       0       0       0       0       0       0       0       0       0       0       2       2       2
        2

0       0       2       2       2       2       2       2       2       2       0       1       2       3       3
        3

0       1       2       3       3       3       3       3       3       3       0       1       2       3       10
        11

0       1       2       3       10      11      12      13      13      13      0       2       3       4       10
        12

0       2       3       4       10      12      13      14      15      15      0       2       3       4       10
        12

0       2       3       4       10      12      13      14      15      15      0       2       4       6       10
        12


the optimal solution is 12
the solution vector is:
1       0       1       0       0
--------------------------------
Process exited after 205.4 seconds with return value 0
Press any key to continue . . .
```