Experiment-8

Program: 0/1 Knapsack

```c
#include <stdio.h>
#include <stdlib.h>

int max(int a, int b)
{
    if (a > b)
        return a;
    else
        return b;
}

void printObj(int n, int w, int dp[][w+1], int wt[])
{
    int i = n, j = w;
    printf("\nFollowing is the list of objects which are included
and not included in the Knapsack to earn maximum profit-\n\n");
    while(i>0 && j>0)
    {
        if (dp[i][j] == dp[i-1][j])
        {
            printf("Object %d not included\n",i);
            i--;
        }
        else
        {
            printf("Object %d included\n",i);
            i--;
            j = j - wt[i];
        }
    }
    printf("\n");
}

int knapsackDP(int n, int m, int wt[], int pt[])
{
    int i, j;
    int kn_tbl[n+1][m+1];
    for(i=0; i<=n; i++)
    {
        for(j=0; j<=m; j++)
        {
            if(i == 0 || j == 0)
                kn_tbl[i][j] = 0;
            else if(wt[i-1] <= j)
                kn_tbl[i][j] = max(pt[i-1]+kn_tbl[i-1][j-wt[i-1]],
kn_tbl[i-1][j]);
```

```c
            else
                kn_tbl[i][j] = kn_tbl[i-1][j];
        }
    }
    printf("\nFinal Table with profit values:\n\n");
    for(i=0;i<=n;i++)
    {
        for(j=0;j<=m;j++)
        {
            printf("%d\t",kn_tbl[i][j]);
        }
        printf("\n");
    }
    printObj(n, m, kn_tbl, wt);
    return kn_tbl[n][m];
}

int main()
{
    int n, m, i;
    printf("Enter the number of objects: ");
    scanf("%d", &n);
    int pt[n], wt[n];
    printf("Enter the maximum capacity of the knapsack: ");
    scanf("%d", &m);
    printf("Enter the Weights of %d objects:\n",n);
    for(i=0; i<n; i++)
        scanf("%d", &wt[i]);
    printf("Enter the Profits of %d objects:\n",n);
    for(i=0; i<n; i++)
        scanf("%d", &pt[i]);
    printf("The maximum Profit that can be earned is: %d\n",
knapsackDP(n, m, wt, pt));
    return 0;
}
```

Output:

```
Enter the number of objects: 4
Enter the maximum capacity of the knapsack: 10
Enter the Weights of 4 objects:
5
4
6
3
Enter the Profits of 4 objects:
10
40
30
50
```

Final Table with profit values:

```
0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0    10   10   10   10   10   10
0    0    0    0    40   40   40   40   40   50   50
0    0    0    0    40   40   40   40   40   50   70
0    0    0    50   50   50   50   90   90   90   90
```

Following is the list of objects which are included and not included in the Knapsack to earn maximum profit—

Object 4 included
Object 3 not included
Object 2 included
Object 1 not included

The maximum Profit that can be earned is: 90