Lab : 5

Knapsack Program

#include <stdio.h>  
  
#define MAX 100  
  
int n, capacity;  
int weights[MAX], values[MAX];  
int maxValue = 0;  
int selected[MAX], bestSelected[MAX];  
int dp[MAX][MAX];  
  
int max(int a, int b) {  
    return (a > b) ? a : b;  
}  
  
void knapsackBT(int index, int currWeight, int currValue) {  
    if (index == n) {  
        if (currWeight <= capacity && currValue > maxValue) {  
            maxValue = currValue;  
            for (int i = 0; i < n; i++)  
                bestSelected[i] = selected[i];  
        }  
        return;  
    }  
  
    selected[index] = 0;  
    knapsackBT(index + 1, currWeight, currValue);  
  
    if (currWeight + weights[index] <= capacity) {  
        selected[index] = 1;  
        knapsackBT(index + 1, currWeight + weights[index], currValue + values[index]);  
    }  
}  
  
void knapsackDP() {  
    for (int i = 0; i <= n; i++) {  
        for (int w = 0; w <= capacity; w++) {  
            if (i == 0 || w == 0)  
                dp[i][w] = 0;  
            else if (weights[i - 1] <= w)  
                dp[i][w] = max(values[i - 1] + dp[i - 1][w - weights[i - 1]], dp[i - 1][w]);  
            else  
                dp[i][w] = dp[i - 1][w];  
        }  
    }  
}  
  
void printDPTable() {  
    printf("\nDP Table:\n");  
    for (int i = 0; i <= n; i++) {  
        for (int w = 0; w <= capacity; w++) {  
            printf("%2d ", dp[i][w]);  
        }  
        printf("\n");  
    }  
    printf("Maximum value in knapsack: %d\n", dp[n][capacity]);  
}  
  
int main() {  
    printf("Enter number of items: ");  
    scanf("%d", &n);  
  
    printf("Enter weights and values of each item:\n");  
    for (int i = 0; i < n; i++) {  
        printf("Item %d - Weight: ", i + 1);  
        scanf("%d", &weights[i]);  
        printf("Item %d - Value: ", i + 1);  
        scanf("%d", &values[i]);  
    }  
  
    printf("Enter knapsack capacity: ");  
    scanf("%d", &capacity);  
  
    knapsackDP();  
    printDPTable();  
  
    knapsackBT(0, 0, 0);  
    printf("\nItems selected (1 = included, 0 = excluded):\n");  
    for (int i = 0; i < n; i++) {  
        printf("Item %d: %d\n", i + 1, bestSelected[i]);  
    }  
  
    return 0;  
}

Output:

