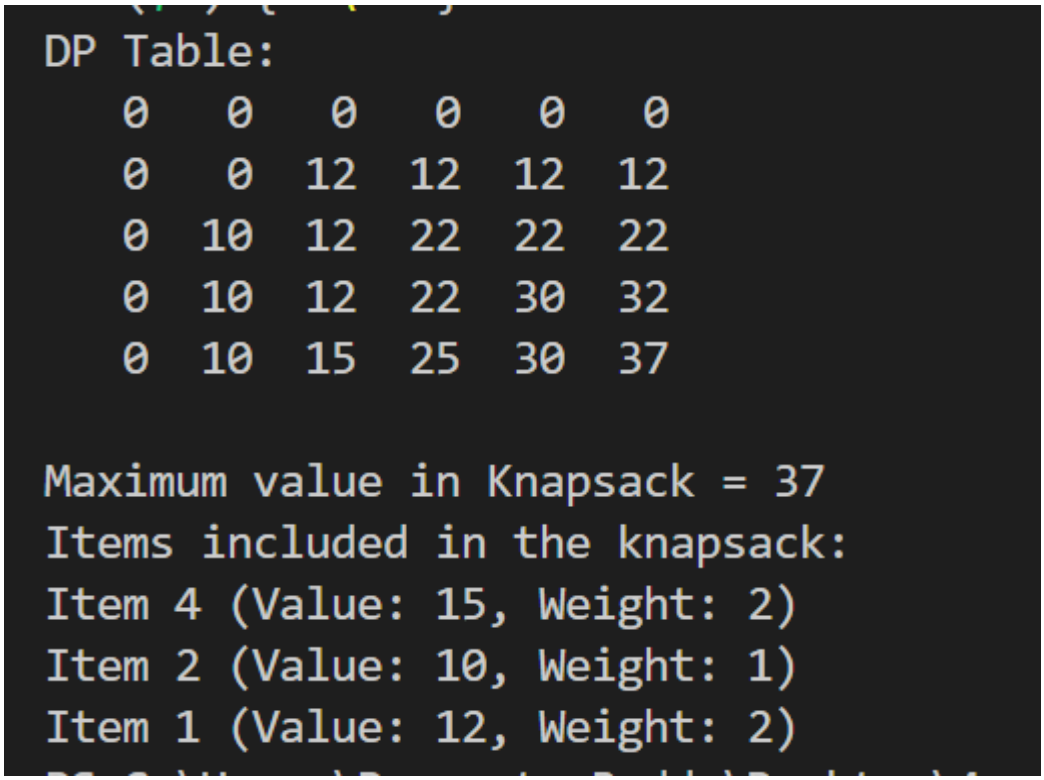
Knapsack Problem

```
#include <stdio.h>

int max(int a, int b) {
   return (a > b) ? a : b;
}

void knapsack(int W, int wt[], int val[], int n) {
   int i, w;
   int K[n + 1][W + 1];

   for (i = 0; i <= n; i++) {
      for (w = 0; w <= W; w++) {
         if (i == 0 || w == 0) {
            K[i][w] = 0;
         } else if (wt[i - 1] <= w) {
            K[i][w] = max(val[i - 1] + K[i - 1][w - wt[i - 1]], K[i - 1][w]);
         } else {
            K[i][w] = K[i - 1][w];
         }
      }
   }

   printf("DP Table:\n");
   for (i = 0; i <= n; i++) {
      for (w = 0; w <= W; w++) {
         printf("%4d", K[i][w]);
      }
      printf("\n");
   }

   int res = K[n][W];
   printf("\nMaximum value in Knapsack = %d\n", res);
   printf("Items included in the knapsack:\n");

   w = W;
   for (i = n; i > 0 && res > 0; i--) {
      if (res == K[i - 1][w])
         continue;
      else {
         printf("Item %d (Value: %d, Weight: %d)\n", i, val[i - 1], wt[i - 1]);
         res -= val[i - 1];
         w -= wt[i - 1];
      }
   }
}
```

```
int main() {
    int n = 4;
    int val[] = {12, 10, 20, 15};
    int wt[] = {2, 1, 3, 2};
    int W = 5;

    knapsack(W, wt, val, n);

    return 0;
}
```

Output



Prims Algorithm

```
#include <stdio.h>
#include <limits.h>

#define MAX 100
#define INF 9999

void prims(int n, int cost[MAX][MAX]) {
    int d[MAX], p[MAX], s[MAX];
    int source, min, sum = 0;
```

```
int T[MAX][2], k = 0;


min = INF;
source = 0;
for (int i = 0; i < n; i++) {
   for (int j = 0; j < n; j++) {
      if (cost[i][j] != 0 && cost[i][j] < min) {
         min = cost[i][j];
         source = i;
      }
   }
}


for (int i = 0; i < n; i++) {
   s[i] = 0;
   d[i] = cost[source][i];
   p[i] = source;
}

s[source] = 1;


for (int i = 1; i < n; i++) {
   min = INF;
   int u = -1;
   for (int j = 0; j < n; j++) {
      if (s[j] == 0 && d[j] < min) {
         min = d[j];
         u = j;
      }
   }
   T[k][0] = u;
   T[k][1] = p[u];
   k++;
   sum += cost[u][p[u]];

   s[u] = 1;
   for (int v = 0; v < n; v++) {
      if (s[v] == 0 && cost[u][v] < d[v]) {
         d[v] = cost[u][v];
         p[v] = u;
      }
   }
}
```

```
    if (sum >= INF) {
        printf("Spanning tree does not exist\n");
    } else {
        printf("Spanning tree exists and MST is:\n");
        for (int i = 0; i < n - 1; i++) {
            printf("%d - %d\n", T[i][0], T[i][1]);
        }
        printf("The cost of the Minimum Spanning Tree is: %d\n", sum);
    }
}

int main() {
    int n;
    int cost[MAX][MAX];

    printf("Enter the number of vertices: ");
    scanf("%d", &n);

    printf("Enter the cost adjacency matrix (use %d to represent infinity):\n", INF);
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            scanf("%d", &cost[i][j]);
        }
    }

    prims(n, cost);

    return 0;
}
```

Output:

```
Enter the number of vertices: 6
Enter the cost adjacency matrix (use 9999 to represent infinity):
0 60 10 9999 9999 9999
60 0 9999 20 40 70
10 9999 0 9999 9999 50
9999 20 99999 0 9999 80
0 40 99999 9999 0 30
9999 70 50 80 30 0
Spanning tree exists and MST is:
2 - 0
5 - 2
4 - 5
1 - 4
3 - 1
The cost of the Minimum Spanning Tree is: 150
```