Insertion Sort -

Executed Code With Output -

C:\Users\Admin\Desktop\AOAL\IS.cpp - [Executing] - Dev-C++ 5.11

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TDM-GCC 4.9.2 64-bit Release

(globals)

Project Classes Debug

IS.cpp

```c
#include <stdio.h>
int main()
{
  int n, array[1000], c, d, t, flag = 0;
  printf("Enter number of elements: \n");
  scanf("%d", &n);
  printf("Enter %d integers\n", n);
  for (c = 0; c < n; c++)
    scanf("%d", &array[c]);
  for (c = 1 ; c <= n - 1; c++)
  {
    t = array[c];
    for (d = c - 1 ; d >= 0; d--)
    {
      if (array[d] > t)
      {
        array[d+1] = array[d];
        flag = 1;
      }
      else
        break;
    }
    if (flag)
      array[d+1] = t;
  }
  printf("Sorted list in ascending order: \n");
  for (c = 0; c <= n - 1; c++) {
    printf("%d\n", array[c]);
  }
  return 0;
}
```

C:\Users\Admin\Desktop\AOAL\IS.exe

```
Enter number of elements:
8
Enter 8 integers
11 7 17 3 9 29 85 9
Sorted list in ascending order:
3
7
9
9
11
17
29
85

--------------------------------
Process exited after 35.12 seconds with return value 0
Press any key to continue . . .
```

Compiler Resources Compile Log Debug Find Results Close

Abort Compilation

Shorten compiler paths

```
- Warnings: 0
- Output Filename: C:\Users\Admin\Desktop\AOAL\IS.exe
- Output Size: 128.7705078125 KiB
- Compilation Time: 3.25s
```

Line: 30 Col: 12 Sel: 0 Lines: 31 Length: 636 Insert Done parsing in 0.032 seconds

Merge Sort -

Executed Code With Output -

```c
#include<stdio.h>
void mergesort(int[], int, int);
void combine(int[], int, int, int);
int main()
{
    int a[10], n, i;
    printf("\n Enter no of elements: ");
    scanf("%d", & n);
    printf("\n Enter the elements: \n");
    for (i = 0; i < n; i++)
    scanf("%d", & a[i]);
    mergesort(a, 0, n - 1);
    printf("\nSorted array is: \n");
    for (i = 0; i < n; i++)
    printf("%d ", a[i]);
    return 0;
}
void mergesort(int a[10], int low, int high)
{
    int mid;
    if (low < high)
    {
        mid = (low + high) / 2;
        mergesort(a, low, mid);
        mergesort(a, mid + 1, high);
        combine(a, low, mid, high);
    }
}
void combine(int a[10], int low, int mid, int high)
{
    int i, j, k, temp[10];

    i = low;
    j = mid + 1;
    k = low;
    while (i <= mid && j <= high)
    {
        if (a[i] < a[j]) {
            temp[k] = a[i];
            k++;
            i++;
        }
        else {
            temp[k] = a[j];
            k++;
            j++;
        }
    }
    while (i <= mid)
    {
        temp[k] = a[i];
        k++;
        i++;
    }
    while (j <= high)
    {
        temp[k] = a[j];
        k++;
        j++;
    }
    for (i = low; i <= high; i++)
    a[i] = temp[i];
}
```

```
C:\Users\Admin\Desktop\AOAL\MS.exe

 Enter no of elements: 9

 Enter the elements:
18 11 2 0 15 12 9 15 16

Sorted array is:
0 2 9 11 12 15 15 16 18
--------------------------------
Process exited after 151.5 seconds with return value 0
Press any key to continue . . .
```

Quick Sort -

Executed Code With Output -

```c
#include<stdio.h>
void quicksort(int[10], int, int);
int main()
{
    int a[20], n, i;
    printf("Enter size of the array: ");
    scanf("%d", & n);
    printf("Enter %d elements: ", n+1);
    for (i = 0; i < n; i++)
    scanf("%d", & a[i]);
    quicksort(a, 0, n - 1);
    printf("Sorted elements: ");
    for (i = 0; i < n; i++)
    printf("%d ", a[i]);
    return 0;
}
void quicksort(int a[10], int first, int last)
{
    int pivot, j, temp, i;
    if (first < last)
    {
        pivot = first;
        i = first;
        j = last;
        while (i < j)
        {
            while (a[i] <= a[pivot] && i < last)
            i++;
            while (a[j] > a[pivot])
            j--;
            if (i < j)
            {
                temp = a[i];
                a[i] = a[j];
                a[j] = temp;
            }
        }
        temp = a[pivot];
        a[pivot] = a[j];
        a[j] = temp;
        quicksort(a, first, j - 1);
        quicksort(a, j + 1, last);
    }
}
```

```
C:\Users\Admin\Desktop\AOAL\QS.exe
Enter size of the array: 9
Enter 10 elements: 54 26 93 17 77 31 44 55 20
Sorted elements: 17 20 26 31 44 54 55 77 93
--------------------------------
Process exited after 19.58 seconds with return value 0
Press any key to continue . . .
```

Minimum and Maximum Element -

Executed Code With Output -

```c
#include <stdio.h>
int a[10], max, min;
void maxmin(int i, int j)
{
    int newmax, newmin, mid;
    if (i == j)
    max = min = a[i];
    else
    {
        if (i == j - 1)
        {
            if (a[i] < a[j])
            {
                max = a[j];
                min = a[i];
            }
            else
            {
                max = a[i];
                min = a[j];
            }
        }
        else
        {
            mid = (i + j) / 2;
            maxmin(i, mid);
            newmax = max;
            newmin = min;
            maxmin(mid + 1, j);
            if (max < newmax)
                max = newmax;
            if (min > newmin)
                min = newmin;
        }
    }
}
int main()
{
    int n, i;
    printf("\nEnter number of elements ");
    scanf("%d", & n);
    printf("\nEnter the elements ");
    for (i = 0; i < n; i++)
    scanf("%d", & a[i]);
    maxmin(0, n - 1);
    printf("\nMaximum element is : %d ", max);
    printf("\nMinimum element is : %d ", min);
    return 0;
}
```

```
C:\Users\Admin\Desktop\AOAL\Min&Max.exe

Enter number of elements 9

Enter the elements 20 10 -4 -8 15 50 45 15 40

Maximum element is : 50
Minimum element is : -8
--------------------------------
Process exited after 19.18 seconds with return value 0
Press any key to continue . . .
```

Fractional Knapsack -

Executed Code With Output -

```c
# include <stdio.h>
int main()
{
    float weight[20], profit[20], capacity;
    int n, i, j;
    float ratio[20], fract = 1.0, tp = 0, temp;
    printf("\nEnter the capacity of knapsack:- ");
    scanf("%f", & capacity);
    printf("\nEnter the no. of items:- ");
    scanf("%d", & n);
    printf("\nEnter the weights and profits of each item:- ");
    for (i = 0; i < n; i++)
    scanf("%f %f", & weight[i], & profit[i]);
    for (i = 0; i < n; i++)
    ratio[i] = profit[i] / weight[i];
    for (i = 0; i < n; i++)
    {
        for (j = i + 1; j < n; j++)
        {
            if (ratio[i] < ratio[j])
            {
                temp = ratio[j];
                ratio[j] = ratio[i];
                ratio[i] = temp;
                temp = weight[j];
                weight[j] = weight[i];
                weight[i] = temp;
                temp = profit[j];
                profit[j] = profit[i];
                profit[i] = temp;
            }
        }
    }
    for (i = 0; i < n; i++)
    {
        if (weight[i] > capacity)
        break;
        else
        {
            tp = tp + profit[i];
            capacity = capacity - weight[i];
        }
    }
    printf("%f ", tp);
    if (i < n)
    fract = capacity / weight[i];
    tp = tp + (fract * profit[i]);
    printf("\nMaximum profit is:- %f ", tp);
    return 0;
}
```

```
C:\Users\Admin\Desktop\AOAL\FK.exe

Enter the capacity of knapsack:- 13

Enter the no. of items:- 6

Enter the weights and profits of each item:- 7 18
2 5
3 9
5 10
3 12
2 7
28.000000
Maximum profit is:- 40.857143
--------------------------------
Process exited after 37.4 seconds with return value 0
Press any key to continue . . .
```

MST - Prim's Algorithm

Executed Code With Output -

```c
#include <stdio.h>
#include <limits.h>
#define vertices 5
int minimum_key(int k[], int mst[])
{
    int minimum  = INT_MAX, min,i;
    for (i = 0; i < vertices; i++)
        if (mst[i] == 0 && k[i] < minimum )
            minimum = k[i], min = i;
    return min;
}
void prim(int g[vertices][vertices])
{
    int parent[vertices];
    int k[vertices];
    int mst[vertices];
    int i, count,edge,v;
    for (i = 0; i < vertices; i++)
    {
        k[i] = INT_MAX;
        mst[i] = 0;
    }
    k[0] = 0;
    parent[0] = -1;
    for (count = 0; count < vertices-1; count++)
    {
        edge = minimum_key(k, mst);
        mst[edge] = 1;
        for (v = 0; v < vertices; v++)
        {
            if (g[edge][v] && mst[v] == 0 && g[edge][v] <  k[v])
            {
                parent[v]  = edge, k[v] = g[edge][v];
            }
        }
    }
    printf("\n Edge \t  Weight\n");
    for (i = 1; i < vertices; i++)
    printf(" %d <-> %d    %d \n", parent[i], i, g[i][parent[i]]);

}
int main()
{
    int g[vertices][vertices] = {{0, 0, 3, 0, 0},
                                 {0, 0, 10, 4, 0},
                                 {3, 10, 0, 2, 6},
                                 {0, 4, 2, 0, 1},
                                 {0, 0, 6, 1, 0},
                                 };
    prim(g);
    return 0;
}
```

```
C:\Users\Admin\Desktop\AOAL\PA.exe

 Edge     Weight
 3 <-> 1    4
 0 <-> 2    3
 2 <-> 3    2
 3 <-> 4    1

--------------------------------
Process exited after 0.4358 seconds with return value 0
Press any key to continue . . .
```

MST - Kruskal's Algorithm

Executed Code With Output -

```c
#include <stdio.h>
#define MAX 30
typedef struct edge {
  int u, v, w;
} edge;
typedef struct edge_list {
  edge data[MAX];
  int n;
} edge_list;
edge_list elist;
int Graph[MAX][MAX], n;
edge_list spanlist;
void kruskalAlgo();
int find(int belongs[], int vertexno);
void applyUnion(int belongs[], int c1, int c2);
void sort();
void print();
void kruskalAlgo() {
  int belongs[MAX], i, j, cno1, cno2;
  elist.n = 0;
  for (i = 1; i < n; i++)
    for (j = 0; j < i; j++) {
      if (Graph[i][j] != 0) {
        elist.data[elist.n].u = i;
        elist.data[elist.n].v = j;
        elist.data[elist.n].w = Graph[i][j];
        elist.n++;
      }
    }
  sort();
  for (i = 0; i < n; i++)
```

```c
    belongs[i] = i;
  spanlist.n = 0;
  for (i = 0; i < elist.n; i++) {
    cno1 = find(belongs, elist.data[i].u);
    cno2 = find(belongs, elist.data[i].v);
    if (cno1 != cno2) {
      spanlist.data[spanlist.n] = elist.data[i];
      spanlist.n = spanlist.n + 1;
      applyUnion(belongs, cno1, cno2);
    }
  }
}
int find(int belongs[], int vertexno) {
  return (belongs[vertexno]);
}
void applyUnion(int belongs[], int c1, int c2) {
  int i;

  for (i = 0; i < n; i++)
    if (belongs[i] == c2)
      belongs[i] = c1;
}
void sort() {
  int i, j;
  edge temp;
  for (i = 1; i < elist.n; i++)
    for (j = 0; j < elist.n - 1; j++)
      if (elist.data[j].w > elist.data[j + 1].w) {
        temp = elist.data[j];
        elist.data[j] = elist.data[j + 1];
        elist.data[j + 1] = temp;
```

```
    }
}
void print() {
  int i, cost = 0;
  for (i = 0; i < spanlist.n; i++) {
    printf("\n%d - %d : %d", spanlist.data[i].u, spanlist.data[i].v, spanlist.data[i].w);
    cost = cost + spanlist.data[i].w;
  }
  printf("\nSpanning tree cost: %d", cost);
}
int main() {
  int i, j, total_cost;
  n = 6;

  Graph[0][0] = 0;
  Graph[0][1] = 4;
  Graph[0][2] = 4;
  Graph[0][3] = 0;
  Graph[0][4] = 0;
  Graph[0][5] = 0;
  Graph[0][6] = 0;

  Graph[1][0] = 4;
  Graph[1][1] = 0;
  Graph[1][2] = 2;
  Graph[1][3] = 0;
  Graph[1][4] = 0;
  Graph[1][5] = 0;
  Graph[1][6] = 0;

  Graph[2][0] = 4;
```

```
    Graph[2][1] = 2;
    Graph[2][2] = 0;
    Graph[2][3] = 3;
    Graph[2][4] = 4;
    Graph[2][5] = 0;
    Graph[2][6] = 0;

    Graph[3][0] = 0;
    Graph[3][1] = 0;
    Graph[3][2] = 3;
    Graph[3][3] = 0;
    Graph[3][4] = 3;
    Graph[3][5] = 0;
    Graph[3][6] = 0;

    Graph[4][0] = 0;
    Graph[4][1] = 0;
    Graph[4][2] = 4;
    Graph[4][3] = 3;
    Graph[4][4] = 0;
    Graph[4][5] = 0;
    Graph[4][6] = 0;

    Graph[5][0] = 0;
    Graph[5][1] = 0;
    Graph[5][2] = 2;
    Graph[5][3] = 0;
    Graph[5][4] = 3;
    Graph[5][5] = 0;
    Graph[5][6] = 0;

    kruskalAlgo();
    print();
}
```

C:\Users\Admin\Desktop\AOAL\KA.exe

```
2 - 1 : 2
5 - 2 : 2
3 - 2 : 3
4 - 3 : 3
1 - 0 : 4
Spanning tree cost: 14
--------------------------------
Process exited after 0.4115 seconds with return value 0
Press any key to continue . . .
```

```
- Warnings: 0
- Output Filename: C:\Users\Admin\Desktop\AOAL\KA.exe
- Output Size: 130.1455078125 KiB
- Compilation Time: 2.14s
```

APSP - Floyd Warshall Algorithm

Executed Code With Output -

C:\Users\Admin\Desktop\AOAL\APSP.cpp - [Executing] - Dev-C++ 5.11

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(globals) | TDM-GCC 4.9.2 64-bit Release

Project Classes Debug | APSP.cpp

```c
#include <stdio.h>
#define n 4
#define INF 999
int main()
{
    int A[n][n] ={ {0, 5, 9, INF},{INF, 0, 1, INF},{INF, INF, 0, 2},{INF, 3, INF, 0}};
    int i, j, k;
    for(k = 0; k < n; k++)
    {
        for (i = 0; i < n; i++)
        {
            for (j = 0; j < n; j++)
            {
                if (A[i][k] + A[k][j] < A[i][j])
                A[i][j] = A[i][k] + A[k][j];
            }
        }
    }
    printf("\n The shortest distances from every pair of vertices are:\n");
    for (i = 0; i < n; i++)
    {
        for (j = 0; j < n; j++)
        {
            if (A[i][j] == INF)
                printf("%s\t", "INF");
            else
                printf("%d\t", A[i][j]);
        }
        printf("\n");
    }
}
```

C:\Users\Admin\Desktop\AOAL\APSP.exe

```
 The shortest distances from every pair of vertices are:
0       5       6       8
INF     0       1       3
INF     5       0       2
INF     3       4       0
--------------------------------
Process exited after 0.3764 seconds with return value 0
Press any key to continue . . .
```

Compiler Resources Compile Log Debug Find Results Close

Abort Compilation

- Errors: 0
- Warnings: 0
- Output Filename: C:\Users\Admin\Desktop\AOAL\APSP.exe
- Output Size: 129.7724609375 KiB
- Compilation Time: 1.86s

☐ Shorten compiler paths

Line: 15 Col: 17 Sel: 0 Lines: 31 Length: 608 Insert Done parsing in 0.062 seconds

Longest Common Subsequence -

Executed Code With Output -

```c
#include<stdio.h>
#include<string.h>
char x[20], y[20], b[20][20];
void print_lcs(int i, int j)
{
    if(i==0 || j==0)
    return;
    if(b[i][j]=='c')
    {
        print_lcs(i-1,j-1);
        printf("%c",x[i-1]);
    }
    else if(b[i][j]=='u')
        print_lcs(i-1,j);
    else
        print_lcs(i,j-1);
    }
int main()
{
    int i,j,m,n,c[20][20];
    printf("\nEnter the 1st sequence: ");
    scanf("%s",x);
    printf("\nEnter the 2nd sequence: ");
    scanf("%s",y);
    printf("\nThe Longest Common Subsequence is: ");
    m=strlen(x);
    n=strlen(y);
    for(i=0;i<=m;i++)
    c[i][0]=0;
    for(i=0;i<=n;i++)

    for(i=1;i<=m;i++)
    {
        for(j=1;j<=n;j++)
        {
            if(x[i-1]==y[j-1])
            {
                c[i][j]=c[i-1][j-1]+1;
                b[i][j]='c';
            }
            else if(c[i-1][j]>=c[i][j-1])
            {
                c[i][j]=c[i-1][j];
                b[i][j]='u';
            }
            else
            {
                c[i][j]=c[i][j-1];
                b[i][j]='l';
            }
        }
    }
    print_lcs(m,n);
}
```

```
C:\Users\Admin\Desktop\AOAL\LCS.exe

Enter the 1st sequence: ACBAED

Enter the 2nd sequence: ABCABE

The Longest Common Subsequence is: ACBE
--------------------------------
Process exited after 10.74 seconds with return value 0
Press any key to continue . . .
```

```
#include <stdio.h>                                                    //AIML51_SUDHAM
void subsetSum(int set[], int subSet[], int n, int subSize, int total, int nodeCount ,int sum)
{
        int i;
        if(total==sum && subSize >1)
        {
                printf("\n");
                for(i = 0; i < subSize; i++)
                        printf(" %d",subSet[i]);
                subsetSum(set,subSet,n,subSize-1,total-set[nodeCount],nodeCount+1,sum);
                //for other subsets
        return;
        }
        else
        {
                for(i=nodeCount; i < n; i++ )
                { //find node along breadth
                        subSet[subSize] = set[i];
                        subsetSum(set,subSet,n,subSize+1,total+set[i],i+1,sum);
                        //do for (next node in depth
                }
        }
}
int main()
{
        int weights[50], size, sum,i,n;
        int subSet[50]; //create subset array to pass parameter of subsetSum
        printf("\n Enter the sum : ");
        scanf("%d",&sum);
        printf("\n Enter the no. of elements: ");
        scanf("%d",&n);
        printf("\n Enter the of elements: ");
        for(i=0;i<n;i++)
        scanf("%d",&weights[i]);
        subsetSum(weights, subSet, n, 0, 0, 0, sum);
}
```

```
Select C:\Users\Admin\Desktop\AOAL\SOS.exe

 Enter the sum : 20

 Enter the no. of elements: 6

 Enter the of elements: 3 5 7 8 9 15

 3 8 9
 5 7 8
 5 15
--------------------------------
Process exited after 15.88 seconds with return value 0
Press any key to continue . . .
```

```
#include<stdio.h>                                                    //AIML51_SUDHAM
#include<conio.h>
int m=0,n=4;
int cal(int temp[10][10],int t[10][10])
{
        int i,j,m=0;
        for(i=0;i < n;i++)
                for(j=0;j < n;j++)
                {
                        if(temp[i][j]!=t[i][j])
                        m++;
                }
        return m;
}
int check(int a[10][10],int t[10][10])
{
        int i,j,f=1;
        for(i=0;i < n;i++)
                for(j=0;j < n;j++)
                        if(a[i][j]!=t[i][j])
                                f=0;
        return f;
}
int main()
{
        int p,i,j,n=4,a[10][10],t[10][10],temp[10][10],r[10][10];
        int m=0,x=0,y=0,d=1000,dmin=0,l=0;
        printf("\nEnter the matrix to be solved,space with zero :\n");
        for(i=0;i < n;i++)
                for(j=0;j < n;j++)
                        scanf("%d",&a[i][j]);

        printf("\nEnter the target matrix,space with zero :\n");
        for(i=0;i < n;i++)
                for(j=0;j < n;j++)
                        scanf("%d",&t[i][j]);

        printf("\nEntered Matrix is :\n");
        for(i=0;i < n;i++)
        {
```

```
        for(j=0;j < n;j++)
                printf("%d\t",a[i][j]);
        printf("\n");
}
printf("\nTarget Matrix is :\n");
for(i=0;i < n;i++)
{
        for(j=0;j < n;j++)
                printf("%d\t",t[i][j]);
        printf("\n");
}
while(!(check(a,t)))
{
        l++;
        d=1000;
        for(i=0;i < n;i++)
                for(j=0;j < n;j++)
                {
                        if(a[i][j]==0)
                        {
                                x=i;
                                y=j;
                        }
                }
        //To move upwards
        for(i=0;i < n;i++)
                for(j=0;j < n;j++)
                        temp[i][j]=a[i][j];
        if(x!=0)
        {
                p=temp[x][y];
                temp[x][y]=temp[x-1][y];
                temp[x-1][y]=p;
        }
        m=cal(temp,t);
        dmin=l+m;
        if(dmin < d)
        {
                d=dmin;
                for(i=0;i < n;i++)
```

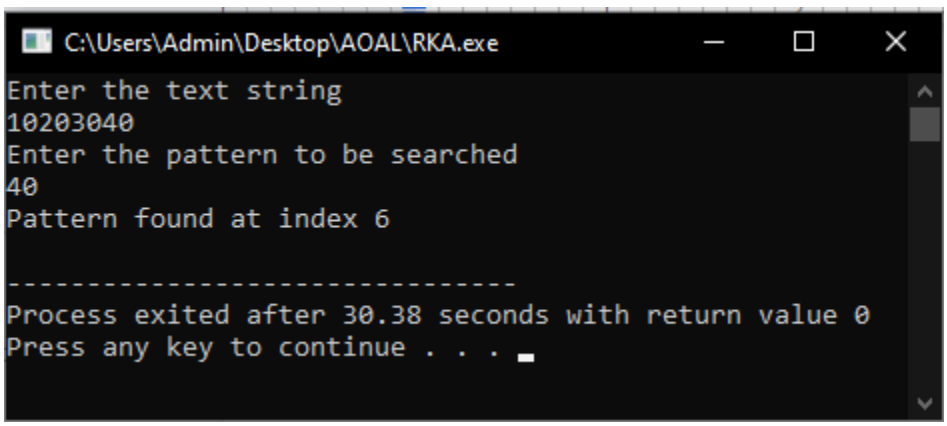
```
                for(j=0;j < n;j++)
                        r[i][j]=temp[i][j];
}
//To move downwards
for(i=0;i < n;i++)
        for(j=0;j < n;j++)
                temp[i][j]=a[i][j];
if(x!=n-1)
{
        p=temp[x][y];
        temp[x][y]=temp[x+1][y];
        temp[x+1][y]=p;
}
m=cal(temp,t);
dmin=l+m;
if(dmin < d)
{
        d=dmin;
        for(i=0;i < n;i++)
                for(j=0;j < n;j++)
                        r[i][j]=temp[i][j];
}
//To move right side
for(i=0;i < n;i++)
        for(j=0;j < n;j++)
                temp[i][j]=a[i][j];
if(y!=n-1)
{
        p=temp[x][y];
        temp[x][y]=temp[x][y+1];
        temp[x][y+1]=p;
}
m=cal(temp,t);
dmin=l+m;
if(dmin < d)
{
        d=dmin;
        for(i=0;i < n;i++)
                for(j=0;j < n;j++)
                        r[i][j]=temp[i][j];
```

```
                }
                //To move left
                for(i=0;i < n;i++)
                        for(j=0;j < n;j++)
                                temp[i][j]=a[i][j];
                if(y!=0)
                {
                        p=temp[x][y];
                        temp[x][y]=temp[x][y-1];
                        temp[x][y-1]=p;
                }
                m=cal(temp,t);
                dmin=l+m;
                if(dmin < d)
                {
                        d=dmin;
                        for(i=0;i < n;i++)
                                for(j=0;j < n;j++)
                                        r[i][j]=temp[i][j];
                }
                printf("\nCalculated Intermediate Matrix Value :\n");
                for(i=0;i < n;i++)
                {
                        for(j=0;j < n;j++)
                          printf("%d\t",r[i][j]);
                        printf("\n");
                }
                for(i=0;i < n;i++)
                        for(j=0;j < n;j++)
                        {
                          a[i][j]=r[i][j];
                          temp[i][j]=0;
                        }
                printf("Minimum cost : %d\n",d);
        }
}
//AIML51_SUDHAM
```

```
C:\Users\Admin\Desktop\AOAL\15-PP.exe

Enter the matrix to be solved,space with zero :
1 2 3 4
5 6 0 8
9 10 7 11
13 14 15 12

Enter the target matrix,space with zero :
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 0

Entered Matrix is :
1       2       3       4
5       6       0       8
9       10      7       11
13      14      15      12

Target Matrix is :
1       2       3       4
5       6       7       8
9       10      11      12
13      14      15      0

Calculated Intermediate Matrix Value :
1       2       3       4
5       6       7       8
9       10      0       11
13      14      15      12
Minimum cost : 4

Calculated Intermediate Matrix Value :
1       2       3       4
5       6       7       8
9       10      11      0
13      14      15      12
Minimum cost : 4

Calculated Intermediate Matrix Value :
1       2       3       4
5       6       7       8
9       10      11      12
13      14      15      0
Minimum cost : 3

--------------------------------
Process exited after 53.09 seconds with return value 0
Press any key to continue . . .
```

```
#include<stdio.h>                                                    //AIML51_SUDHAM
#include<string.h>
int main ()
{
        char txt[80], pat[80], flag=0;
        int q = 101; // prime number
        int d = 256;
        printf ("Enter the text string \n");
        scanf ("%s", txt);
        printf ("Enter the pattern to be searched \n");
        scanf ("%s", pat);
        int M = strlen(txt);
        int N = strlen (pat);
        int i, j;
        int p = 0; // hash value for pattern
        int t = 0; // hash value for text
        int h = 1;
        for (i = 0; i < N - 1; i++)
                h = (h * d) % q;
        for (i = 0; i < N; i++)
        {
                p = (d * p + pat[i]) % q;
                t = (d * t + txt[i]) % q;
        }
        for (i = 0; i <= M - N; i++)
        {
                if (p == t)
                {
                        for (j = 0; j < N; j++)
                        {
                                if (txt[i + j] != pat[j])
                                break;
                        }
                        if (j == N)
                        {
                                printf ("Pattern found at index %d \n", i);
```

```
                        flag=1;
                }
        }
        if (i < M - N)
        {
                t = (d * (t - txt[i] * h) + txt[i + N]) % q;
                if (t < 0)
                t = (t + q);
        }
    }
    if (flag==0)
    printf("\n Pattern not found\n");
}
```

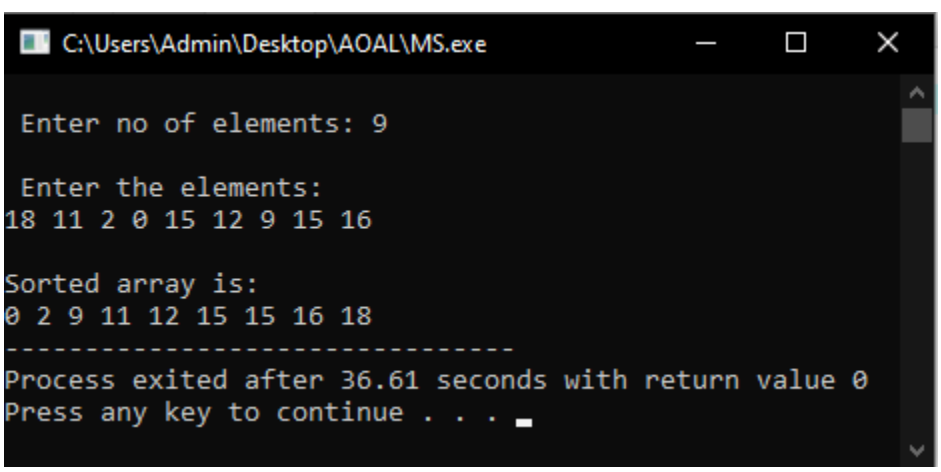


```
#include <stdio.h>
int main()
{
  int n, array[1000], c, d, t, flag = 0;
  printf("Enter number of elements: \n");
  scanf("%d", &n);
  printf("Enter %d integers\n", n);
  for (c = 0; c < n; c++)
    scanf("%d", &array[c]);
  for (c = 1 ; c <= n - 1; c++)
  {
    t = array[c];
    for (d = c - 1 ; d >= 0; d--)
        {
      if (array[d] > t)
          {
        array[d+1] = array[d];
        flag = 1;
      }
      else
        break;
    }
    if (flag)
      array[d+1] = t;
  }
  printf("Sorted list in ascending order: \n");
  for (c = 0; c <= n - 1; c++) {
    printf("%d\n", array[c]);
  }
  return 0;
}
```

```
C:\Users\Admin\Desktop\AOAL\IS.exe
Enter number of elements:
8
Enter 8 integers
11 7 17 3 9 29 85 9
Sorted list in ascending order:
3
7
9
9
11
17
29
85

--------------------------------
Process exited after 53.13 seconds with return value 0
Press any key to continue . . .
```

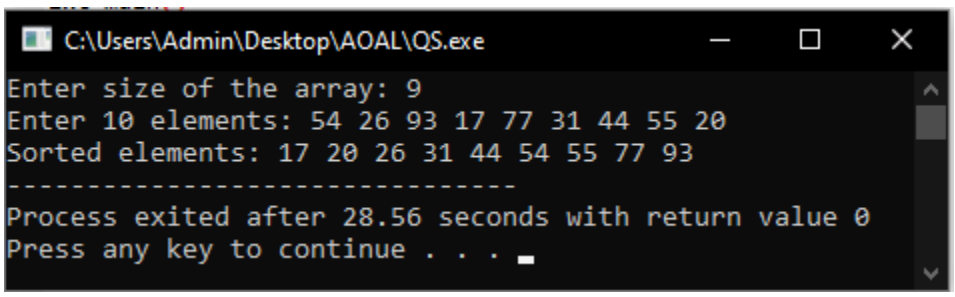
```
#include<stdio.h>
void mergesort(int[], int, int);
void combine(int[], int, int, int);
int main()
{
	int a[10], n, i;
	printf("\n Enter no of elements: ");
	scanf("%d", & n);
	printf("\n Enter the elements: \n");
	for (i = 0; i < n; i++)
	scanf("%d", & a[i]);
	mergesort(a, 0, n - 1);
	printf("\nSorted array is: \n");
	for (i = 0; i < n; i++)
	printf("%d ", a[i]);
	return 0;
}
void mergesort(int a[10], int low, int high)
{
	int mid;
	if (low < high)
	{
		mid = (low + high) / 2;
		mergesort(a, low, mid);
		mergesort(a, mid + 1, high);
		combine(a, low, mid, high);
	}
}
void combine(int a[10], int low, int mid, int high)
{
	int i, j, k, temp[10];
	i = low;
	j = mid + 1;
	k = low;
	while (i <= mid && j <= high)
	{
		if (a[i] < a[j]) {
			temp[k] = a[i];
			k++;
			i++;
```

```
            }
            else {
                temp[k] = a[j];
                k++;
                j++;
            }
        }
        while (i <= mid)
        {
            temp[k] = a[i];
            k++;
            i++;
        }
        while (j <= high)
        {
            temp[k] = a[j];
            k++;
            j++;
        }
        for (i = low; i <= high; i++)
        a[i] = temp[i];
}
```



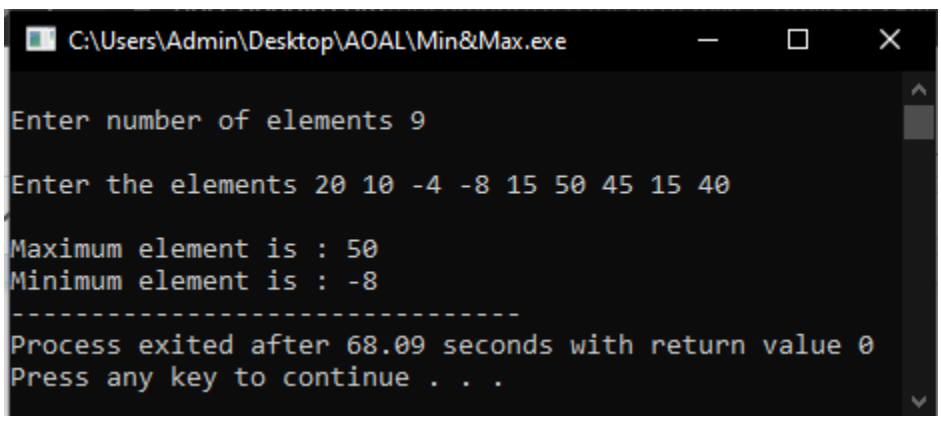
```
#include<stdio.h>
void quicksort(int[10], int, int);
int main()
{
	int a[20], n, i;
	printf("Enter size of the array: ");
	scanf("%d", & n);
	printf("Enter %d elements: ", n+1);
	for (i = 0; i < n; i++)
	scanf("%d", & a[i]);
	quicksort(a, 0, n - 1);
	printf("Sorted elements: ");
	for (i = 0; i < n; i++)
	printf("%d ", a[i]);
	return 0;
}
void quicksort(int a[10], int first, int last)
{
	int pivot, j, temp, i;
	if (first < last)
	{
		pivot = first;
		i = first;
		j = last;
		while (i < j)
		{
			while (a[i] <= a[pivot] && i < last)
			i++;
			while (a[j] > a[pivot])
			j--;
			if (i < j)
			{
				temp = a[i];
```

```
                a[i] = a[j];
                a[j] = temp;
            }
        }
        temp = a[pivot];
        a[pivot] = a[j];
        a[j] = temp;
        quicksort(a, first, j - 1);
        quicksort(a, j + 1, last);
    }
}
```



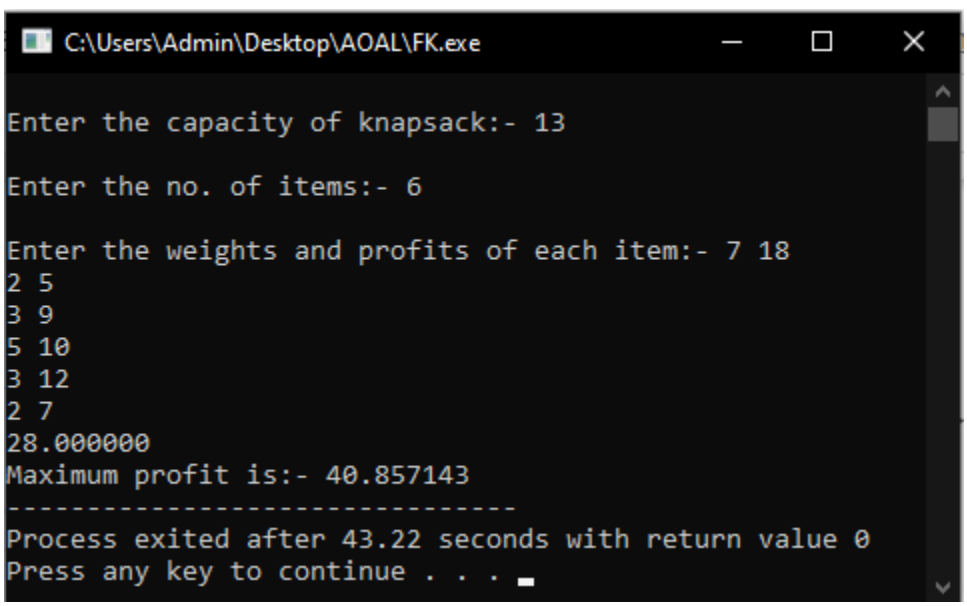
```
#include <stdio.h>
int a[10], max, min;
void maxmin(int i, int j)
{
	int newmax, newmin, mid;
	if (i == j)
	max = min = a[i];
	else
	{
		if (i == j - 1)
		{
			if (a[i] < a[j])
			{
				max = a[j];
				min = a[i];
			}
			else
			{
				max = a[i];
				min = a[j];
			}
		}
		else
		{
			mid = (i + j) / 2;
			maxmin(i, mid);
			newmax = max;
			newmin = min;
			maxmin(mid + 1, j);
			if (max < newmax)
				max = newmax;
			if (min > newmin)
				min = newmin;
```

```
            }
        }
}
int main()
{
        int n, i;
        printf("\nEnter number of elements ");
        scanf("%d", & n);
        printf("\nEnter the elements ");
        for (i = 0; i < n; i++)
        scanf("%d", & a[i]);
        maxmin(0, n - 1);
        printf("\nMaximum element is : %d ", max);
        printf("\nMinimum element is : %d ", min);
        return 0;
}
```



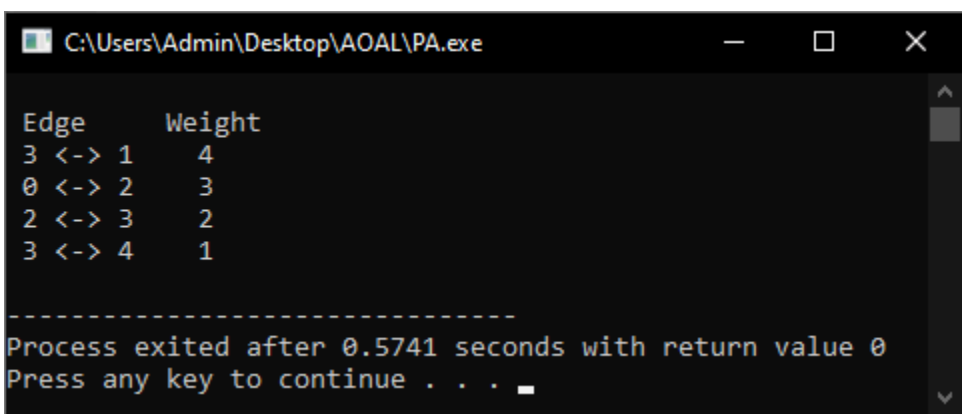
```
# include <stdio.h>
int main()
{
        float weight[20], profit[20], capacity;
        int n, i, j;
        float ratio[20], fract = 1.0, tp = 0, temp;
        printf("\nEnter the capacity of knapsack:- ");
        scanf("%f", & capacity);
        printf("\nEnter the no. of items:- ");
        scanf("%d", & n);
        printf("\nEnter the weights and profits of each item:- ");
        for (i = 0; i < n; i++)
        scanf("%f %f", & weight[i], & profit[i]);
        for (i = 0; i < n; i++)
        ratio[i] = profit[i] / weight[i];
        for (i = 0; i < n; i++)
        {
                for (j = i + 1; j < n; j++)
                {
                        if (ratio[i] < ratio[j])
                        {
                                temp = ratio[j];
                                ratio[j] = ratio[i];
                                ratio[i] = temp;
                                temp = weight[j];
                                weight[j] = weight[i];
                                weight[i] = temp;
                                temp = profit[j];
                                profit[j] = profit[i];
                                profit[i] = temp;
                        }
                }
        }
```

```
        for (i = 0; i < n; i++)
        {
                if (weight[i] > capacity)
                break;
                else
                {
                        tp = tp + profit[i];
                        capacity = capacity - weight[i];
                }
        }
        printf("%f ", tp);
        if (i < n)
        fract = capacity / weight[i];
        tp = tp + (fract * profit[i]);
        printf("\nMaximum profit is:- %f ", tp);
        return 0;
}
```



```
#include <stdio.h>
#include <limits.h>
#define vertices 5
int minimum_key(int k[], int mst[])
{
    int minimum  = INT_MAX, min,i;
    for (i = 0; i < vertices; i++)
        if (mst[i] == 0 && k[i] < minimum )
            minimum = k[i], min = i;
    return min;
}
void prim(int g[vertices][vertices])
{
    int parent[vertices];
    int k[vertices];
    int mst[vertices];
    int i, count,edge,v;
    for (i = 0; i < vertices; i++)
    {
        k[i] = INT_MAX;
        mst[i] = 0;
    }
    k[0] = 0;
    parent[0] = -1;
    for (count = 0; count < vertices-1; count++)
    {
        edge = minimum_key(k, mst);
        mst[edge] = 1;
        for (v = 0; v < vertices; v++)
        {
            if (g[edge][v] && mst[v] == 0 && g[edge][v] <  k[v])
            {
                parent[v]  = edge, k[v] = g[edge][v];
```

```
        }
      }
    }
    printf("\n Edge \t  Weight\n");
    for (i = 1; i < vertices; i++)
    printf(" %d <-> %d    %d \n", parent[i], i, g[i][parent[i]]);

}
int main()
{
   int g[vertices][vertices] = {{0, 0, 3, 0, 0},
                                {0, 0, 10, 4, 0},
                                {3, 10, 0, 2, 6},
                                {0, 4, 2, 0, 1},
                                {0, 0, 6, 1, 0},
                                };
   prim(g);
   return 0;
}
```

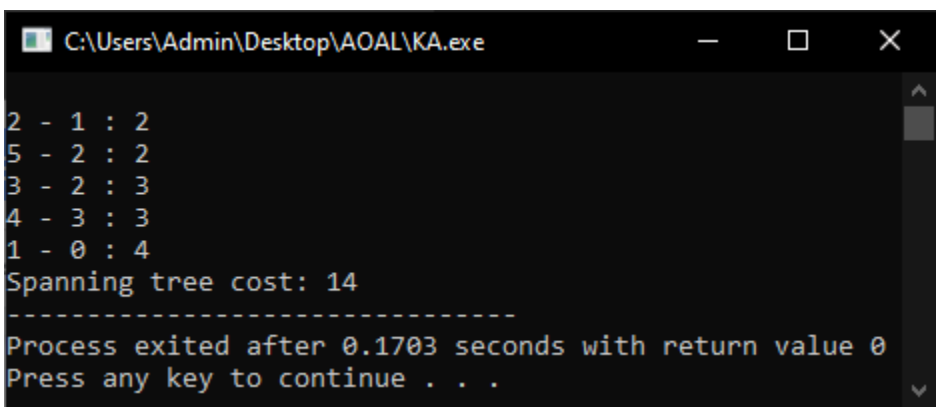


```
#include <stdio.h>
#define MAX 30
typedef struct edge {
  int u, v, w;
} edge;
typedef struct edge_list {
  edge data[MAX];
  int n;
} edge_list;
edge_list elist;
int Graph[MAX][MAX], n;
edge_list spanlist;
void kruskalAlgo();
int find(int belongs[], int vertexno);
void applyUnion(int belongs[], int c1, int c2);
void sort();
void print();
void kruskalAlgo() {
  int belongs[MAX], i, j, cno1, cno2;
  elist.n = 0;
  for (i = 1; i < n; i++)
    for (j = 0; j < i; j++) {
      if (Graph[i][j] != 0) {
        elist.data[elist.n].u = i;
        elist.data[elist.n].v = j;
        elist.data[elist.n].w = Graph[i][j];
        elist.n++;
      }
    }
  sort();
  for (i = 0; i < n; i++)
    belongs[i] = i;
  spanlist.n = 0;
  for (i = 0; i < elist.n; i++) {
    cno1 = find(belongs, elist.data[i].u);
    cno2 = find(belongs, elist.data[i].v);
```

```
    if (cno1 != cno2) {
      spanlist.data[spanlist.n] = elist.data[i];
      spanlist.n = spanlist.n + 1;
      applyUnion(belongs, cno1, cno2);
    }
  }
}
int find(int belongs[], int vertexno) {
  return (belongs[vertexno]);
}
void applyUnion(int belongs[], int c1, int c2) {
  int i;

  for (i = 0; i < n; i++)
    if (belongs[i] == c2)
      belongs[i] = c1;
}
void sort() {
  int i, j;
  edge temp;
  for (i = 1; i < elist.n; i++)
    for (j = 0; j < elist.n - 1; j++)
      if (elist.data[j].w > elist.data[j + 1].w) {
        temp = elist.data[j];
        elist.data[j] = elist.data[j + 1];
        elist.data[j + 1] = temp;
      }
}
void print() {
  int i, cost = 0;
  for (i = 0; i < spanlist.n; i++) {
    printf("\n%d - %d : %d", spanlist.data[i].u, spanlist.data[i].v, spanlist.data[i].w);
    cost = cost + spanlist.data[i].w;
  }
  printf("\nSpanning tree cost: %d", cost);
}
```

```
int main() {
  int i, j, total_cost;
  n = 6;

  Graph[0][0] = 0;
  Graph[0][1] = 4;
  Graph[0][2] = 4;
  Graph[0][3] = 0;
  Graph[0][4] = 0;
  Graph[0][5] = 0;
  Graph[0][6] = 0;

  Graph[1][0] = 4;
  Graph[1][1] = 0;
  Graph[1][2] = 2;
  Graph[1][3] = 0;
  Graph[1][4] = 0;
  Graph[1][5] = 0;
  Graph[1][6] = 0;

  Graph[2][0] = 4;
  Graph[2][1] = 2;
  Graph[2][2] = 0;
  Graph[2][3] = 3;
  Graph[2][4] = 4;
  Graph[2][5] = 0;
  Graph[2][6] = 0;

  Graph[3][0] = 0;
  Graph[3][1] = 0;
  Graph[3][2] = 3;
  Graph[3][3] = 0;
  Graph[3][4] = 3;
  Graph[3][5] = 0;
  Graph[3][6] = 0;
```

```
  Graph[4][0] = 0;
  Graph[4][1] = 0;
  Graph[4][2] = 4;
  Graph[4][3] = 3;
  Graph[4][4] = 0;
  Graph[4][5] = 0;
  Graph[4][6] = 0;

  Graph[5][0] = 0;
  Graph[5][1] = 0;
  Graph[5][2] = 2;
  Graph[5][3] = 0;
  Graph[5][4] = 3;
  Graph[5][5] = 0;
  Graph[5][6] = 0;

  kruskalAlgo();
  print();
}
```



```
#include <stdio.h>
#define n 4
#define INF 999
int main()
{
	int A[n][n] ={ {0, 5, 9, INF},{INF, 0, 1, INF},{INF, INF, 0, 2},{INF, 3, INF,
0}};
	int i, j, k;
	for(k = 0; k < n; k++)
	{
		for (i = 0; i < n; i++)
		{
			for (j = 0; j < n; j++)
			{
				if (A[i][k] + A[k][j] < A[i][j])
				A[i][j] = A[i][k] + A[k][j];
			}
		}
	}
	printf("\n The shortest distances from every pair of vertices are:\n");
	for (i = 0; i < n; i++)
	{
		for (j = 0; j < n; j++)
		{
			if (A[i][j] == INF)
				printf("%s\t", "INF");
			else
				printf("%d\t", A[i][j]);
		}
		printf("\n");
	}
}
```

```
C:\Users\Admin\Desktop\AOAL\APSP.exe

 The shortest distances from every pair of vertices are:
0       5       6       8
INF     0       1       3
INF     5       0       2
INF     3       4       0

--------------------------------
Process exited after 0.7998 seconds with return value 0
Press any key to continue . . .
```

```
#include<stdio.h>
#include<string.h>
char x[20], y[20], b[20][20];
void print_lcs(int i, int j)
{
	if(i==0 || j==0)
	return;
	if(b[i][j]=='c')
	{
		print_lcs(i-1,j-1);
		printf("%c",x[i-1]);
	}
	else if(b[i][j]=='u')
		print_lcs(i-1,j);
	else
		print_lcs(i,j-1);
	}
int main()
{
	int i,j,m,n,c[20][20];
	printf("\nEnter the 1st sequence: ");
	scanf("%s",x);
	printf("\nEnter the 2nd sequence: ");
	scanf("%s",y);
	printf("\nThe Longest Common Subsequence is: ");
	m=strlen(x);
	n=strlen(y);
	for(i=0;i<=m;i++)
	c[i][0]=0;
	for(i=0;i<=n;i++)
		c[0][i]=0;
	for(i=1;i<=m;i++)
	{
```

```
            for(j=1;j<=n;j++)
            {
                if(x[i-1]==y[j-1])
                {
                    c[i][j]=c[i-1][j-1]+1;
                    b[i][j]='c';
                }
                else if(c[i-1][j]>=c[i][j-1])
                {
                    c[i][j]=c[i-1][j];
                    b[i][j]='u';
                }
                else
                {
                    c[i][j]=c[i][j-1];
                    b[i][j]='l';
                }
            }
        }
        print_lcs(m,n);
}
```