

1) Project Idea: Duality theory

2) Project Requirements:

- find the duals

1. use maximization problem.
2. using 2D array dynamic.
3. make matrix A.
4. find the transpose of A.
5. make minimization.

3-Team Work

Student Name		
Ahmed Ashraf Saber		

3) How to use the program:

1. Enter total variables (number of **X** in the equation).
2. Enter total constrains (number of **equations** in the subject to (S.T))
3. Enter the coefficients of x in the **MAX Z** equation.
4. Enter the coefficients of x that are found in the **ST** equations.

```
#include<iostream>
#include<string>
using namespace std;
int main()
{
    int c,v;
    cout<<"Total Variables :";
    cin>>v;
    cout<<"Total Constraints :";
    cin>>c;
    int **arr;
    arr=new int *[c+1];
    for(int i=0;i<(c+1);i++)
    {
        arr[i]=new int[v+1];
    }
    int **new_arr;
    new_arr=new int *[v+1];
    for(int i=0;i<(v+1);i++)
    {
        new_arr[i]=new int[c+1];
    }
    cout<<"\n";
    cout<<"MAX Z= ";
    for(int i=0;i<(v);i++)
    {
        cin>>arr[c][i];
    }
    cout<<"S.T ";
    for(int i=0;i<(c);i++)
    {
        for(int j=0;j<(v+1);j++)
        {
            cin>>arr[i][j];
        }
    }
    arr[c][v]=0;
    cout<<"\n";
    cout<<"A = ";
    for(int i=0;i<(c+1);i++)
    {
        for(int j=0;j<(v+1);j++)
        {
            cout<<"\t";
            cout<<arr[i][j]<<" ";
        }
        cout<<endl;
    }
    cout<<"\n";
    cout<<"At = ";
```

```

for(int i=0;i<(c+1);i++)
{
    for(int j=0;j<(v+1);j++)
    {
        new_arr[j][i]=arr[i][j];
    }
}
for(int i=0;i<(v+1);i++)
{
    for(int j=0;j<(c+1);j++)
    {
        cout<<"\t";
        cout<<new_arr[i][j]<<" ";
    }
    cout<<endl;
}
cout<<endl;
for(int i=0;i<1;i++) // diplay min
{
    int k=0;
    cout<<"Min W = ";
    for(int j=0;j<(c);j++)
    {
        cout<<"("<<new_arr[v][j]<<")"<<"y"<<++k;
        if(k<c)
            cout<<" + ";
    }
    cout<<endl;
}
cout<<"S.T\n";
for(int i=0;i<(v);i++) // display subject to
{
    int k=0;
    cout<<"\t ";
    for(int j=0;j<(c+1);j++)
    {
        cout<<"("<<new_arr[i][j]<<")";
        if(k<(c-1))
            cout<<"y"<<++k<<" + ";
        else if(j<c)
            cout<<" >= ";
    }
    cout<<endl;
}
cout<<"\t ";
for(int i=1;i<(c+1);i++)
{
    cout<<"y"<<i;
    if(i<c)
        cout<<",";
}
cout<<" >= 0\n";
delete [] arr;
delete [] new_arr;
}

```

$$\max Z = 10x_1 + 24x_2$$

S.T

$$x_1 + 2x_2 \leq 120$$

$$x_1 + 4x_2 \leq 180$$

$$x_1, x_2 \geq 0 \quad (1)$$

$$\text{Min } F = 120y_1 + 180y_2$$

S.T

$$1y_1 + y_2 \geq 10$$

$$2y_1 + 4y_2 \geq 24$$

$$y_1, y_2 \geq 0 \quad (2)$$

- Note that in (1) the inequalities are all \leq , but in (2) they are all \geq .

```

C:\WINDOWS\system32\cmd.exe
Total Variables :2
Total Constraints :2

MAX Z= 10 24
S.T
    1 2 120
    1 4 180

A =      1      2      120
        1      4      180
        10     24      0

At =     1      1      10
        2      4      24
        120    180     0

Min W = (120)y1 + (180)y2
S.T
    (1)y1 + (1) >= (10)
    (2)y1 + (4) >= (24)
    y1,y2 >= 0
Press any key to continue . . .

```