<--->

Sample Source Code :-

```
#include<iostream>
#include<stdlib.h>
#include<graphics.h>
#include<math.h>

using namespace std;

class POLYGON
{
   private:
   int p[10][10], Trans_result[10][10], Trans_matrix[10][10];
   float Rotation_result[10][10], Rotation_matrix[10][10];
   float Scaling_result[10][10], Scaling_matrix[10][10];
   float Shearing_result[10][10], Shearing_matrix[10][10];
   int Reflection_result[10][10], Reflection_matrix[10][10];

   public:
   int accept_poly(int[][10]);
   void draw_poly(int[][10], int);
   void draw_polyfloat(float[][10], int);
   void matmult(int[][10], int[][10], int, int, int, int[][10]);
   void matmultfloat(float[][10], int[][10], int, int, int, float[][10]);
   void shearing(int[][10], int);
   void scaling(int[][10], int);
   void rotation(int[][10], int);
   void translation(int[][10], int);
   void reflection(int[][10], int);
};

int POLYGON ::accept_poly(int p[][10])
{
   int i, n;
   cout <<"\n\n\t\tEnter no. of vertices : ";
   cin >> n;
   for (i = 0; i < n; i++)
   {
      cout << "\n\n\t\tEnter (x, y) CO-ordinate of points P" << i << " : ";
      cin >> p[i][0] >> p[i][1];
      p[i][2] = 1;
   }

   for (i = 0; i < n; i++)
   {
      cout << "\n";
      for (int j = 0; j < 3; j++)
      {
         cout << p[i][j] << "\t";
      }
   }
   return n;
}
```

```
void POLYGON ::draw_poly(int p[][10], int n)
{
   int i, gd = DETECT, gm;
   initgraph(&gd, &gm, NULL);
   line (320, 0, 320, 480);
   line(0, 240, 640, 240);

   for (i = 0; i < n; i++)
   {
      if (i < n-1)
      {
         line(p[i][0]+320, -p[i][1]+240, p[i+1][0]+320, -p[i+1][1]+240);
      }
      else
      {
         line(p[i][0]+320, -p[i][1]+240, p[0][0]+320, -p[0][1]+240);
      }
   }
   delay(3000);
}

void POLYGON ::draw_polyfloat(float p[][10], int n)
{

   int i, gd = DETECT, gm;
   initgraph(&gd, &gm, NULL);
   line (320, 0, 320, 480);
   line(0, 240, 640, 240);

   for (i = 0; i < n; i++)
   {
      if (i < n-1)
      {
         line(p[i][0]+320, -p[i][1]+240, p[i+1][0]+320, -p[i+1][1]+240);
      }
      else
      {
         line(p[i][0]+320, -p[i][1]+240, p[0][0]+320, -p[0][1]+240);
      }
   }
   delay(8000);
}

void POLYGON ::translation(int p[10][10], int n)
{
   int tx, ty, i, j; int i1, j1, k1, r1, c1, c2;
   r1 = n; c1 = c2 = 3;
   cout << "\n\n\t\tEnter X-Translation tx : ";
   cin >> tx;
   cout << "\n\n\t\tEnter Y-Translation ty : ";
   cin >> ty;
   for (i = 0; i < 3; i++)
   {
      for (j = 0; j < 3; j++)
```

```
        {
            Trans_matrix[i][j] = 0;
        }
    }
    Trans_matrix[0][0] = Trans_matrix[1][1] = Trans_matrix[2][2] = 1;
    Trans_matrix[2][0] = tx;
    Trans_matrix[2][1] = ty;

    for (i1 = 0; i1 < 10; i1++)
    {
       for (j1 = 0; j1 < 10; j1++)
        {
            Trans_result[i1][j1] = 0;
        }
    }

    for (i1 = 0; i1 < r1; i1++)
    {
       for (j1 = 0; j1 < c2; j1++)
       {
          for (k1 = 0; k1 < c1; k1++)
          {
             Trans_result[i1][j1] = Trans_result[i1][j1]+(p[i1][k1] * Trans_matrix[k1][j1]);

          }
       }
    }
    cout << "\n\n\t\tPolygon after Translation : ";
    draw_poly(Trans_result, n);
}

void POLYGON ::rotation(int p[][10], int n)
{
    float type, Ang, Sinang, Cosang;
    int i, j; int i1, j1, k1, r1, c1, c2;
    r1 = n; c1 = c2 = 3;
    cout << "\n\n\t\tEnter the angle of rotation in degrees : ";
    cin >> Ang;
    cout << "\n\n**** Rotation Type ****";
    cout << "\n\n\t\t1. Clockwise Rotation \n\n\t\t2. Anti-Clockwise Rotation ";
    cout << "\n\n\t\tEnter your choice(1-2) :";
    cin >> type;
    Ang = (Ang * 6.2832)/ 360;
    Sinang = sin (Ang);
    Cosang = cos (Ang);
    cout  << "Mark1";

    for (i = 0; i < 3; i++)
    {
       for (j = 0; j < 3; j++)
       {
          Rotation_matrix[i][j] = 0;
       }
    }
```

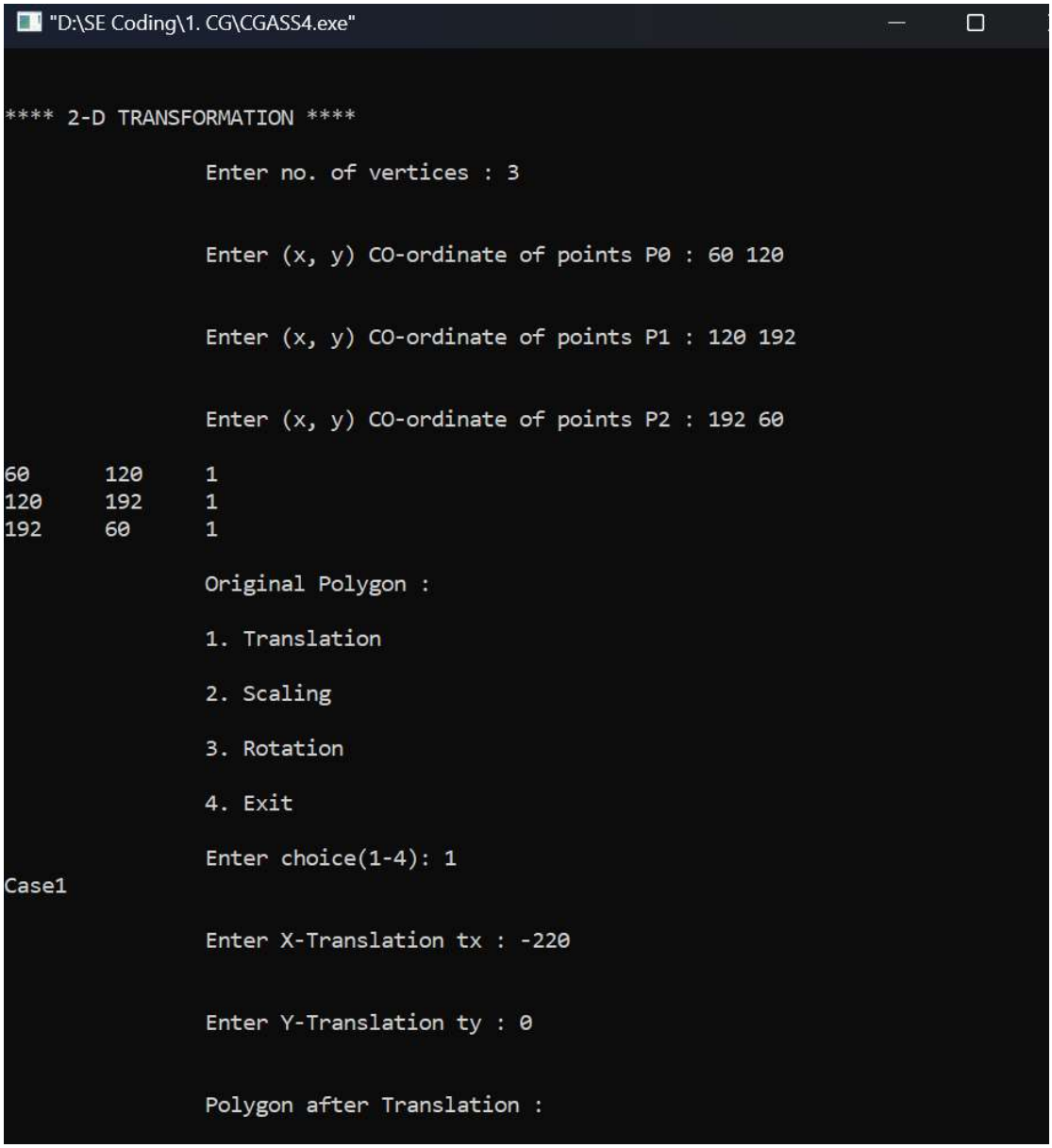
```
   cout << "Mark2";
   Rotation_matrix[0][0] = Rotation_matrix[1][1] = Cosang;
   Rotation_matrix[0][1] = Rotation_matrix[1][0] = Sinang;
   Rotation_matrix[2][2] = 1;

   if (type == 1)
   {
      Rotation_matrix[0][1] = -Sinang;
   }
   else
   {
      Rotation_matrix[1][0] = -Sinang;
   }

   for (i1 = 0; i1 < 10; i1++)
   {
      for (j1 = 0; j1 < 10; j1++)
      {
         Rotation_result[i1][j1] = 0;
      }
   }

   for (i1 = 0; i1 < r1; i1++)
   {
      for (j1 = 0; j1 < c2; j1++)
      {
         for (k1 = 0; k1 < c1; k1++)
         {
            Rotation_result[i1][j1] = Rotation_result[i1][j1] + (p[i1][k1] * Rotation_matrix[k1]
[j1]);

         }
      }
   }

   cout << "\n\n\t\tPolygon After rotation : ";
   for (i = 0; i < n; i++)
   {
      cout << "\n";
      for (int j = 0; j < 3; j++)
      {
         cout << Rotation_result[i][j] << "\t";
      }
   }
   draw_polyfloat(Rotation_result, n);
}

void POLYGON ::scaling(int p[][10], int n)
{
   float Sx, Sy;
   int i, j; int i1, j1, k1, r1, c1, c2;
   r1 =n; c1 = c2 = 3;
   cout << "\n\n\t\tEnter X-Scaling Sx : ";
   cin >> Sx;
   cout << "\n\n\t\tEnter Y-Scaling Sy : ";
```

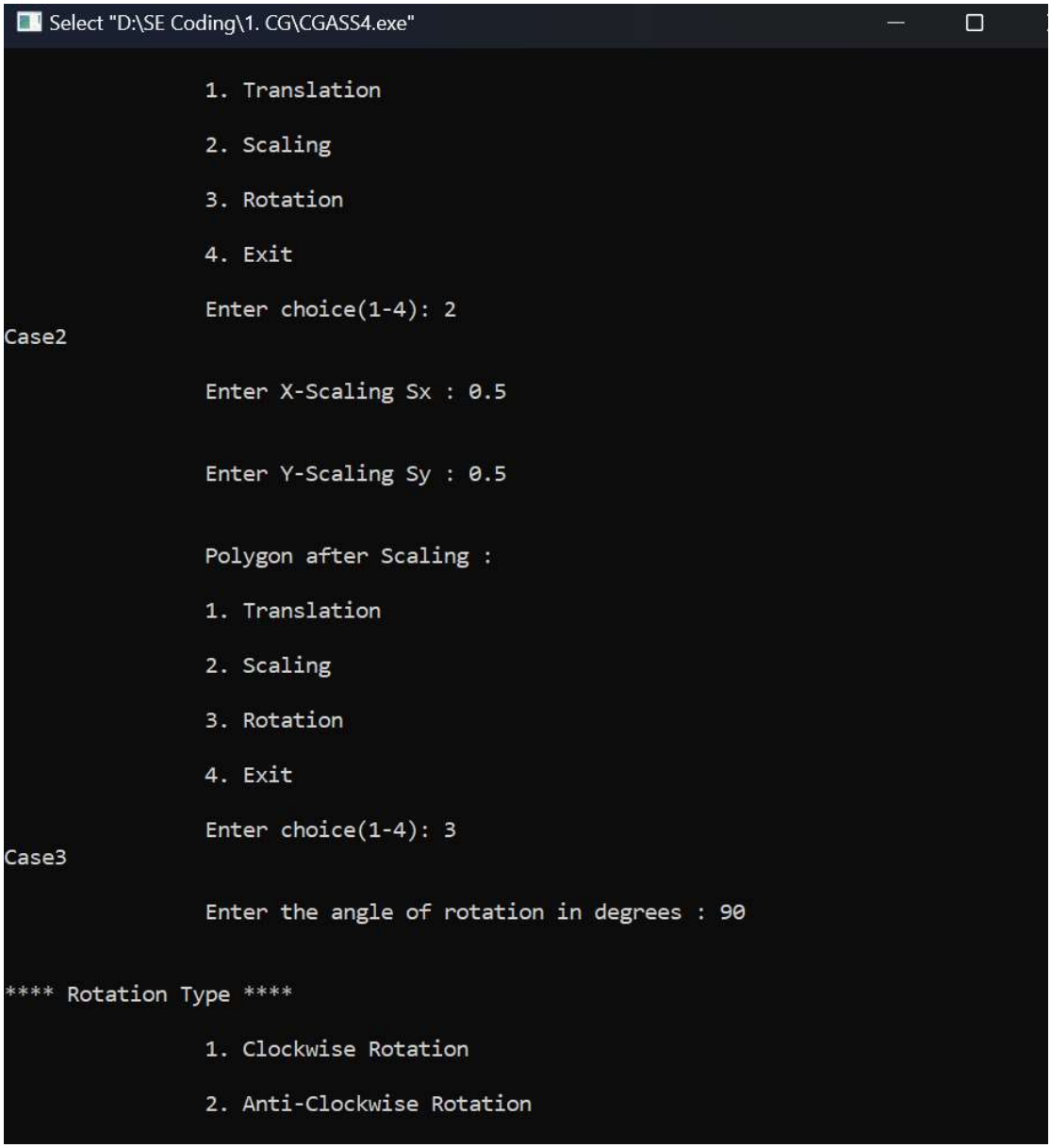
```
   cin >> Sy;

   for (i = 0; i < 3; i++)
   {
      for (j = 0; j < 3; j++)
      {
         Scaling_matrix[i][j] = 0;
      }
   }

   Scaling_matrix[0][0] = Sx;
   Scaling_matrix[0][1] = 0;
   Scaling_matrix[0][2] = 0;
   Scaling_matrix[1][0] = 0;
   Scaling_matrix[1][1] = Sy;
   Scaling_matrix[1][2] = 0;
   Scaling_matrix[2][0] = 0;
   Scaling_matrix[2][1] = 0;
   Scaling_matrix[2][2] = 1;

   for (i1 = 0; i1 < 10; i1++)
   {
      for (j1 = 0; j1 < 10; j1++)
      {
         Scaling_result[i1][j1] = 0;
      }
   }

   for (i1 = 0; i1 < r1; i1++)
   {
      for (j1 = 0; j1 < c2; j1++)
      {
         for (k1 = 0; k1 < c1; k1++)
         {
            Scaling_result[i1][j1] = Scaling_result[i1][j1] + (p[i1][k1] * Scaling_matrix[k1]
[j1]);

         }
      }
   }

   cout << "\n\n\t\tPolygon after Scaling : ";
   draw_polyfloat(Scaling_result, n);
}

int main ()
{
   int ch, n, p[10][10];
   POLYGON p1;
   cout << "\n\n**** 2-D TRANSFORMATION ****";
   n = p1.accept_poly(p);

   cout << "\n\n\t\tOriginal Polygon : ";
   p1.draw_poly(p,n);
```

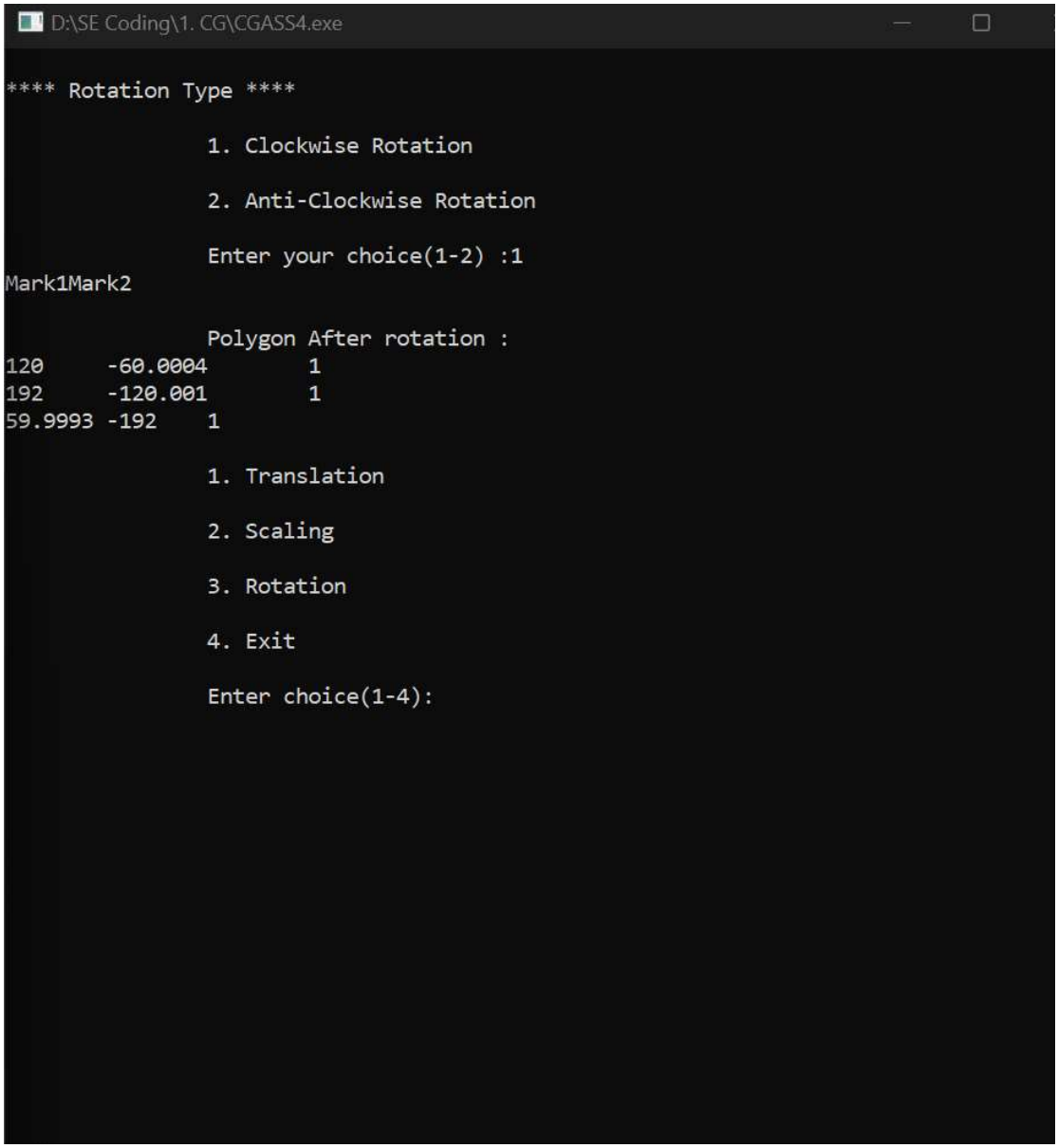
```
    do
    {
        int ch;
        cout << "\n\n\t\t1. Translation \n\n\t\t2. Scaling \n\n\t\t3. Rotation \n\n\t\t4. Exit";
        cout << "\n\n\t\tEnter choice(1-4): ";
        cin >> ch;

        switch (ch)
        {
        case 1:
            cout << "Case1";
            p1.translation(p, n);
            break;

        case 2:
            cout << "Case2";
            p1.scaling(p, n);
            break;

        case 3:
            cout << "Case3";
            p1.rotation(p, n);
            break;

        case 4:
            exit(0);
        }


    }
    while (1);
    return 0;
}
```

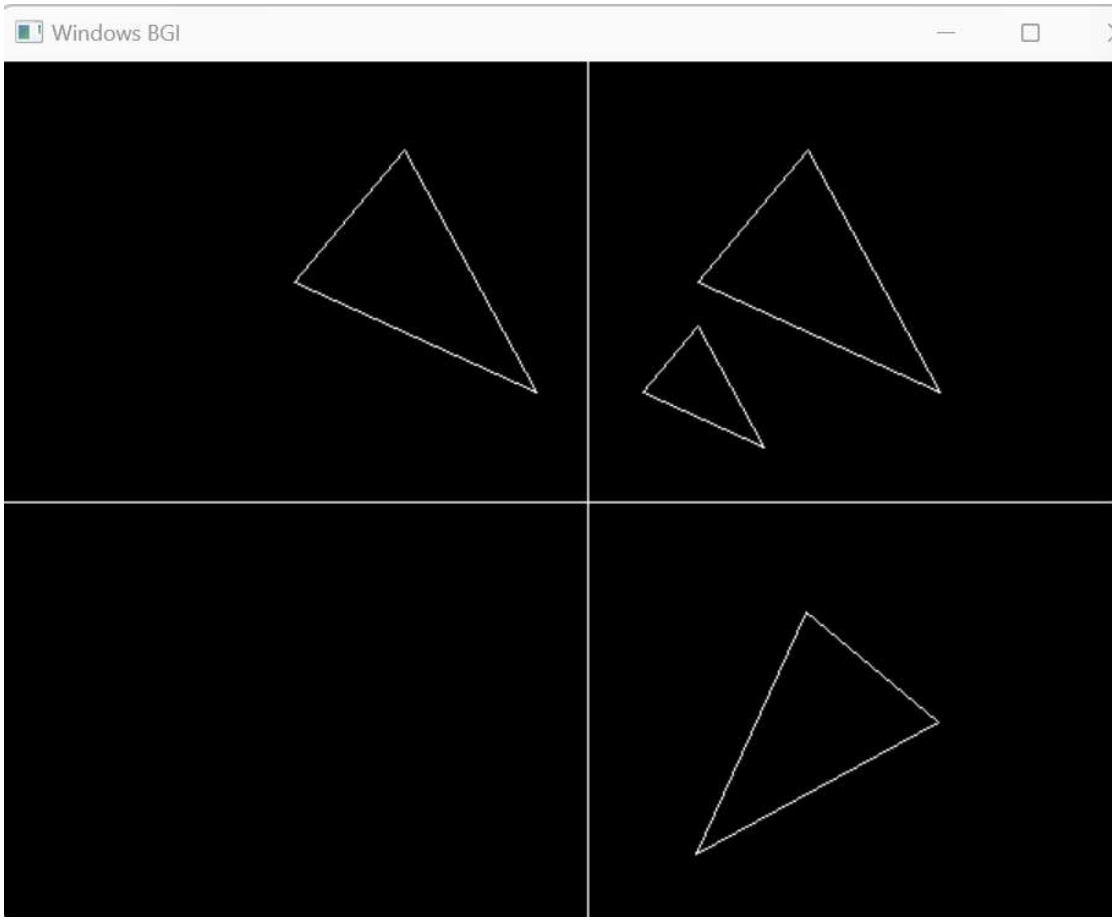
<--->

Sample Output :-


"D:\SE Coding\1. CG\CGASS4.exe"
**** 2-D TRANSFORMATION ****
Enter no. of vertices : 3
Enter (x, y) CO-ordinate of points P0 : 60 120
Enter (x, y) CO-ordinate of points P1 : 120 192
Enter (x, y) CO-ordinate of points P2 : 192 60
60 120 1
120 192 1
192 60 1
Original Polygon :
1. Translation
2. Scaling
3. Rotation
4. Exit
Enter choice(1-4): 1
Case1
Enter X-Translation tx : -220
Enter Y-Translation ty : 0
Polygon after Translation :


Select "D:\SE Coding\1. CG\CGASS4.exe"
1. Translation
2. Scaling
3. Rotation
4. Exit
Enter choice(1-4): 2
Case2
Enter X-Scaling Sx : 0.5
Enter Y-Scaling Sy : 0.5
Polygon after Scaling :
1. Translation
2. Scaling
3. Rotation
4. Exit
Enter choice(1-4): 3
Case3
Enter the angle of rotation in degrees : 90
**** Rotation Type ****
1. Clockwise Rotation
2. Anti-Clockwise Rotation


D:\SE Coding\1. CG\CGASS4.exe
**** Rotation Type ****
1. Clockwise Rotation
2. Anti-Clockwise Rotation
Enter your choice(1-2) :1
Mark1Mark2
Polygon After rotation :
120 -60.0004 1
192 -120.001 1
59.9993 -192 1
1. Translation
2. Scaling
3. Rotation
4. Exit
Enter choice(1-4):


Windows BGI