7. Solve the following

a. Perform 2D Rotation on a given object.

b. Program to create a house like figure and perform the following operations.

i. Scaling about the origin followed by translation.

ii. Scaling with reference to an arbitrary point.

iii. Reflect about the line y = mx + c.

a. Perform 2D Rotation on a given object.

Solution:-

```
#include<graphics.h>
#include<stdio.h>
#include<conio.h>
#include<math.h>
void main()
{
int i;
int gd=DETECT,gm;
int x2,y2,x1,y1,x,y,xn,yn;
double r11,r12,r21,r22,th;
initgraph(&gd,&gm,"C://TurboC++/Disk//TurboC3//BGI");
printf("Enter the two endpoints of a line:x1,y1,x2,y2:\n");
```

```
scanf("%d\n%d\n%d\n%d\n",&x1,&y1,&x2,&y2);
line(x1,y1,x2,y2);
printf("\n\n Enter the angle");
scanf("%lf",&th);
r11=cos((th*3.14)/180);
r12=sin((th*3.14)/180);
r21=(-sin((th*3.14)/180));
r22=cos((th*3.14)/180);
xn=((x2*r11)-(y2*r21));
yn=((x2*r12)+(y2*r22));
line(x1,y1,xn,yn);
getch();
closegraph();
}
```

b. Program to create a house like figure and perform the following operations.

i. Scaling about the origin followed by translation.

ii. Scaling with reference to an arbitrary point.

iii. Reflect about the line y = mx + c.

Solution:-

```
/*  C Program to create house and perform operations in
Graphics  */


#include <stdio.h>
#include <graphics.h>
#include <stdlib.h>
#include <math.h>
#include <conio.h>


void reset (int h[][2])
{
   int val[9][2] = {
                    { 50, 50 },{ 75, 50 },{ 75, 75 },{ 100, 75 },
                    { 100, 50 },{ 125, 50 },{ 125, 100 },{ 87, 125 },{
50, 100 }
                };
   int i;
   for (i=0; i<9; i++)
   {
       h[i][0] = val[i][0]-50;
       h[i][1] = val[i][1]-50;
   }
```

```
}
void draw (int h[][2])
{
   int i;
   setlinestyle (DOTTED_LINE, 0, 1);
   line (320, 0, 320, 480);
   line (0, 240, 640, 240);
   setlinestyle (SOLID_LINE, 0, 1);
   for (i=0; i<8; i++)
      line (320+h[i][0], 240-h[i][1], 320+h[i+1][0], 240-
h[i+1][1]);
   line (320+h[0][0], 240-h[0][1], 320+h[8][0], 240-h[8][1]);
}
void rotate (int h[][2], float angle)
{
   int i;
   for (i=0; i<9; i++)
   {
      int xnew, ynew;
      xnew = h[i][0] * cos (angle) - h[i][1] * sin (angle);
      ynew = h[i][0] * sin (angle) + h[i][1] * cos (angle);
      h[i][0] = xnew; h[i][1] = ynew;
```

```
    }
}
void scale (int h[][2], int sx, int sy)
{
    int i;
    for (i=0; i<9; i++)
    {
        h[i][0] *= sx;
        h[i][1] *= sy;
    }
}
void translate (int h[][2], int dx, int dy)
{
    int i;
    for (i=0; i<9; i++)
    {
        h[i][0] += dx;
        h[i][1] += dy;
    }
}
void reflect (int h[][2], int m, int c)
{
```

```
        int i;
        float angle;
        for (i=0; i<9; i++)
                h[i][1] -= c;
        angle = M_PI/2 - atan (m);
        rotate (h, angle);
        for (i=0; i<9; i++)
                h[i][0] = -h[i][0];
        angle = -angle;
        rotate (h, angle);
        for (i=0; i<9; i++)
                h[i][1] += c;
}

void ini()
{
        int gd=DETECT,gm;
        initgraph(&gd,&gm,"..\\bgi");
}
void dini()
{
        getch();
```

```
        closegraph();
}
void main()
{

        int h[9][2],sx,sy,x,y,m,c,choice;
        do
        {
                clrscr();
                printf("1. Scaling about the origin.\n");
                printf("2. Scaling about an arbitrary point.\n");
                printf("3. Reflection about the line y = mx + c.\n");
                printf("4. Exit\n");
                printf("Enter the choice: ");
                scanf("%d",&choice);
                switch(choice)
                {
                        case 1: printf ("Enter the x- and y-scaling
factors: ");
                                scanf ("%d%d", &sx, &sy);
                                ini();
                                reset (h);
```

```
                draw (h);getch();
                scale (h, sx, sy);
                cleardevice();
                draw (h);
                dini();
                break;

        case 2: printf ("Enter the x- and y-scaling
factors: ");
                scanf ("%d%d", &sx, &sy);
                printf ("Enter the x- and y-coordinates of
the point: ");
                scanf ("%d%d", &x, &y);
                ini();
                reset (h);
                translate (h, x, y);// Go to arbitrary point
                draw(h); getch();//Show its arbitrary
position
                cleardevice();
                translate(h,-x,-y);//Take it back to origin
                draw(h);
                getch();
                cleardevice();
```

```
                scale (h, sx, sy);//Now Scale it
                draw(h);
                getch();
                translate (h, x, y);//Back to Arbitrary
point
                cleardevice();
                draw (h);
                putpixel (320+x, 240-y, WHITE);
                dini();
                break;

        case 3: printf ("Enter the values of m and c: ");
                scanf ("%d%d", &m, &c);
                ini();
                reset (h);
                draw (h); getch();
                reflect (h, m, c);
                cleardevice();
                draw (h);
                dini();
                break;
```

```
                case 4: exit(0);
            }
        }while(choice!=4);
}
```