

Assignment - 5

Title: Curves and fractals.

Aim: a) write C++ program to generate snowflake using fractals. OR  
b) write C++ program to generate Hilbert curve. OR  
c) write C++ program to generate fractal pattern.

Co mapped: CO5.

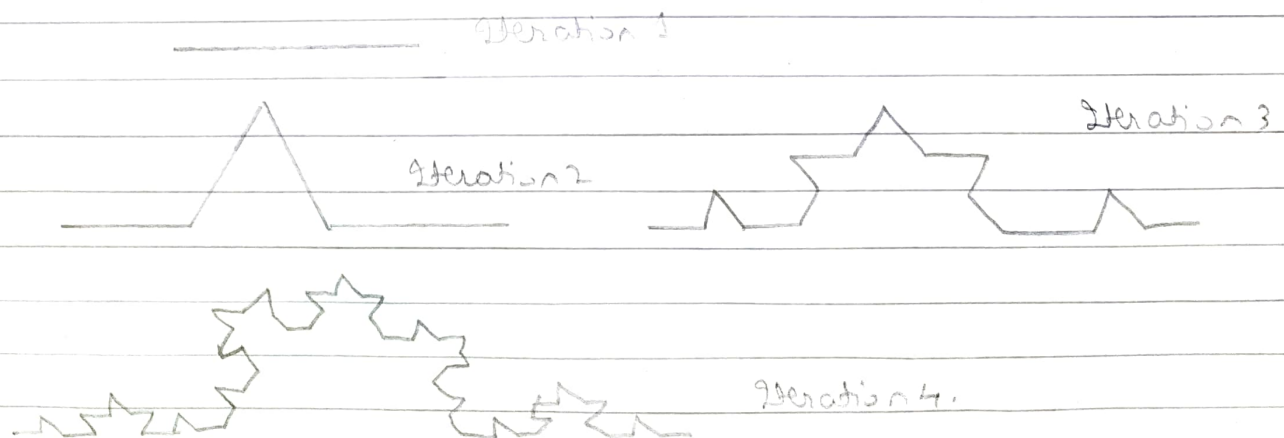
Pre-requisite: 1) Basic programming skills. 2) 64 bit OS.  
3) open source C++ tool like G++ / GCC.

Learning Objective: To study curves and fractals.

Theory: Koch Curve: One of first fractal object described.

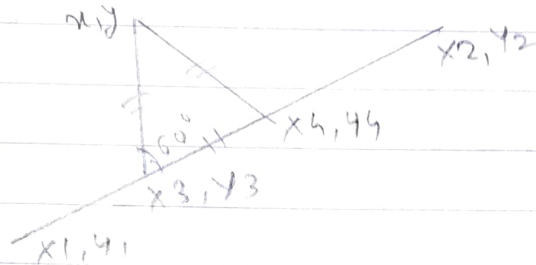
1. Create line and divide in 3 parts.
2. Second part rotated by  $60^\circ$ .
3. Add another part that goes end of part 2.
4. Repeat step 1 to step 3.

Iterations:



Step 1: In iteration 0, we have horizontal line.

Step 2: In iteration 1, line is divided into 3 parts, middle part is rotated  $60^\circ$ , because it forms perfect equilateral triangle.



Step 3: In iteration 2, we repeat step 2.

Hilbert the curve: Space filling curve that visits every point in square grid with  $2 \times 2$ ,  $4 \times 4$ ,  $8 \times 8$ ,  $16 \times 16$ . Applications are in image processing, especially image compression and dithering.

Cups and joins: Basic elements of Hilbert curve are called cups and joins. The open side of cup can be top, bottom, left, right. In addition, every cup has two end-points, and each of these can be 'entry' point or 'exit' point.

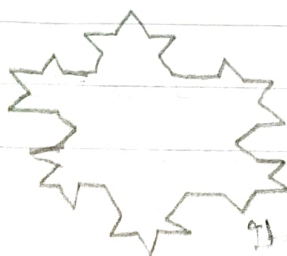
Snowflake curve: It is drawn using Koch curve iterations. we just have single line in starting iteration and in snowflake curve, we have equilateral triangle.



Iteration 0



Iteration 1



Iteration 2

Conclusion:- We performed practical for curves and fractals.

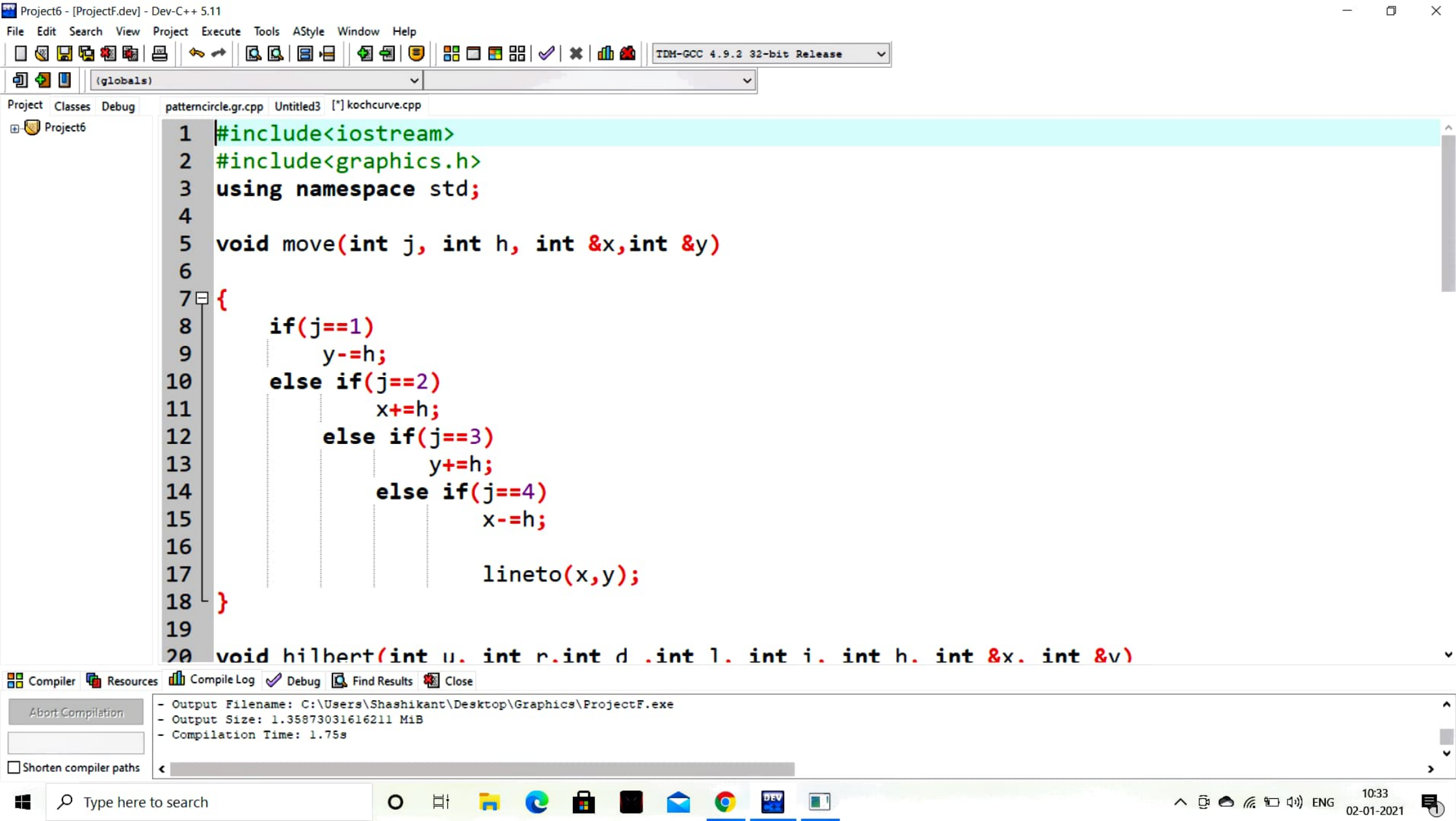
### Questions:

1. what is importance of curves and fractals in computer graphics.
- ⇒ Fractals are important because they define images that are otherwise cannot be defined by Euclidean geometry.

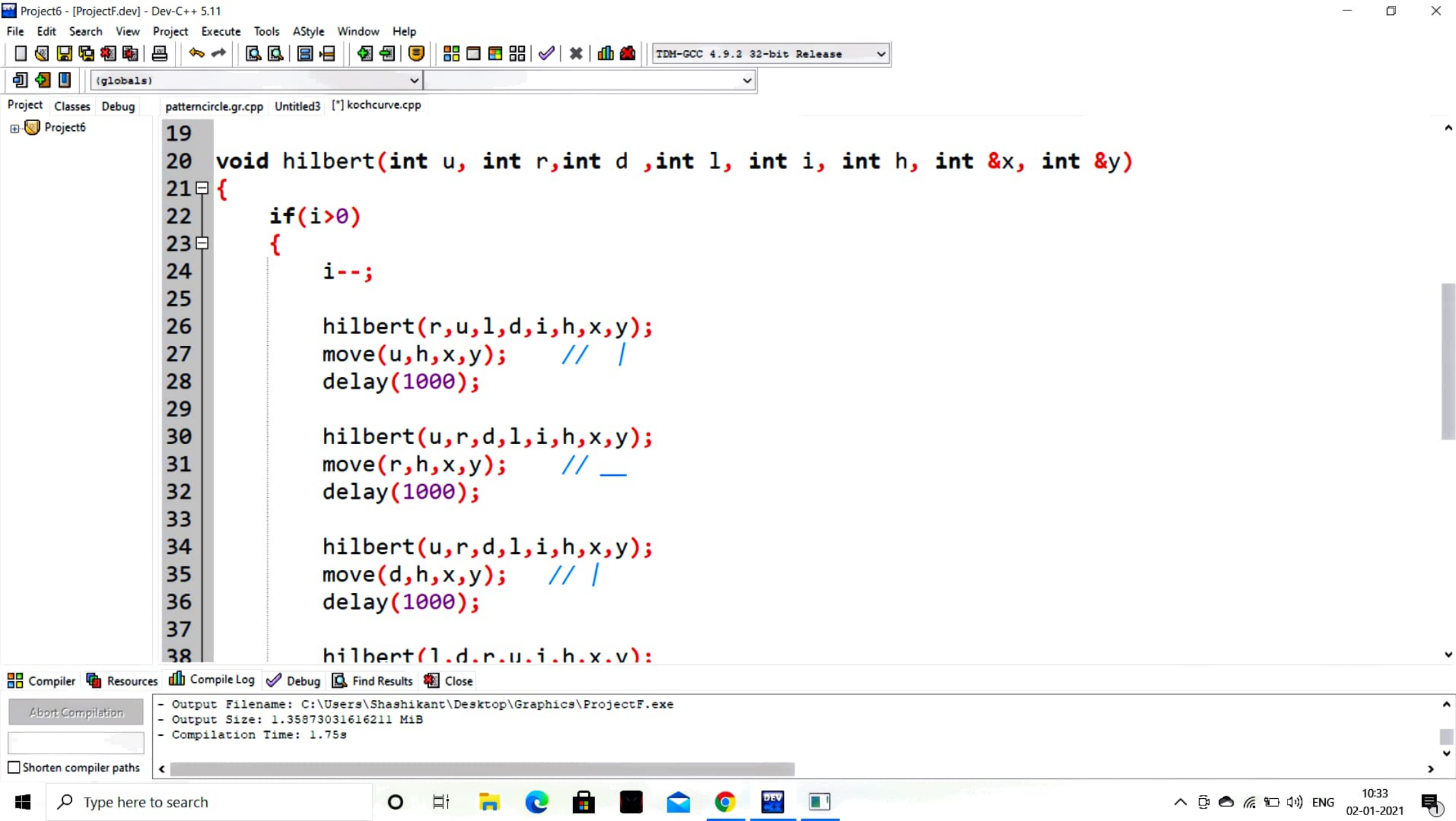
Curves: Infinitely large set of points. Each point has two neighbours except endpoints. They are broadly classified into explicit, implicit and parametric curves.

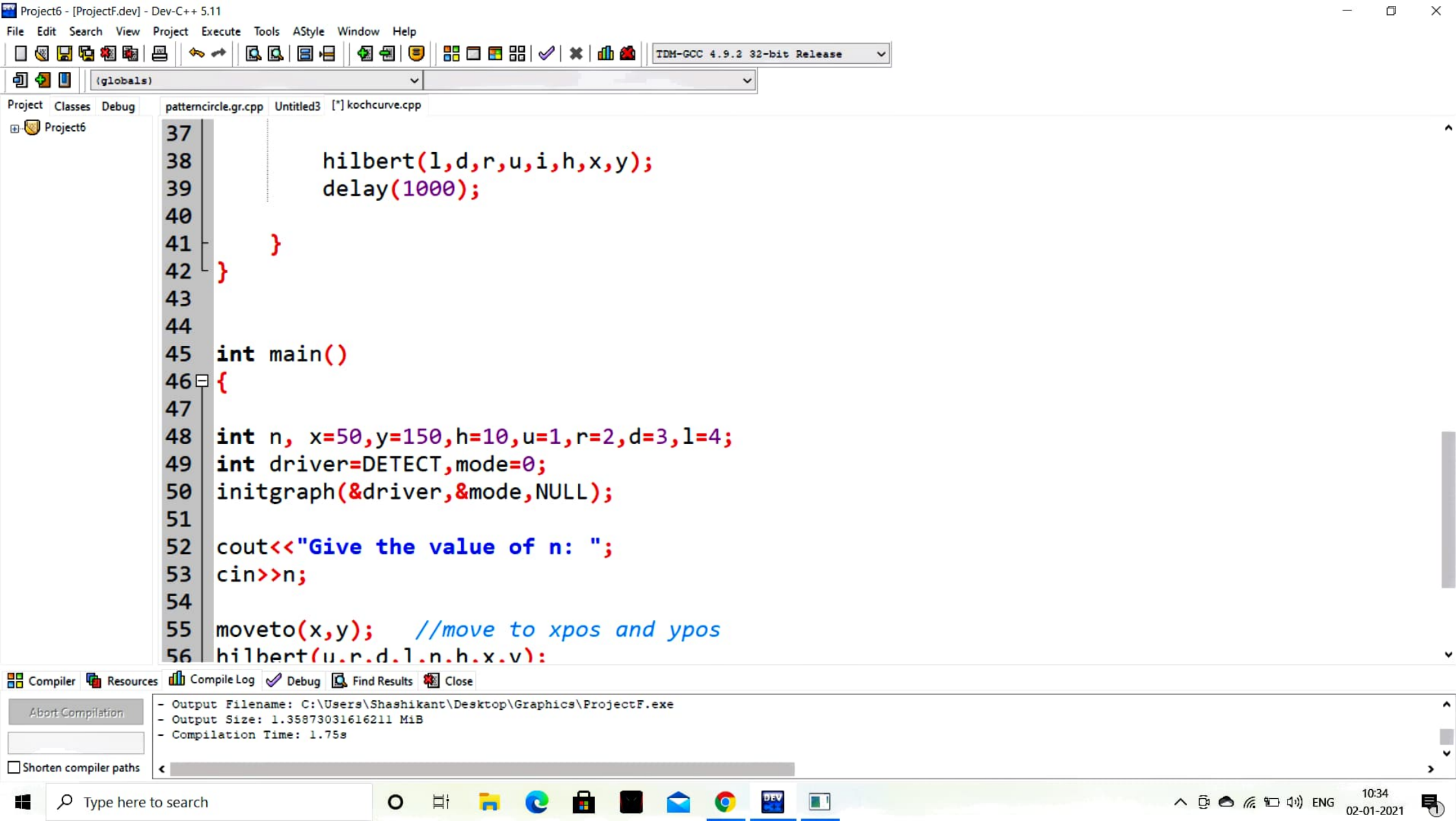
2. what are applications of curve and fractals.
- ⇒ Fractals: They are very complex pictures generated by computer from single formula. It is used for depicting clouds, coastline, borderlines, data compression, diffusion, economy, landscapes, etc.

Curves: They are used in airports to connect runway and taxiway. Reserve curves are useful when laying out such things as pipelines, flumes and levees.





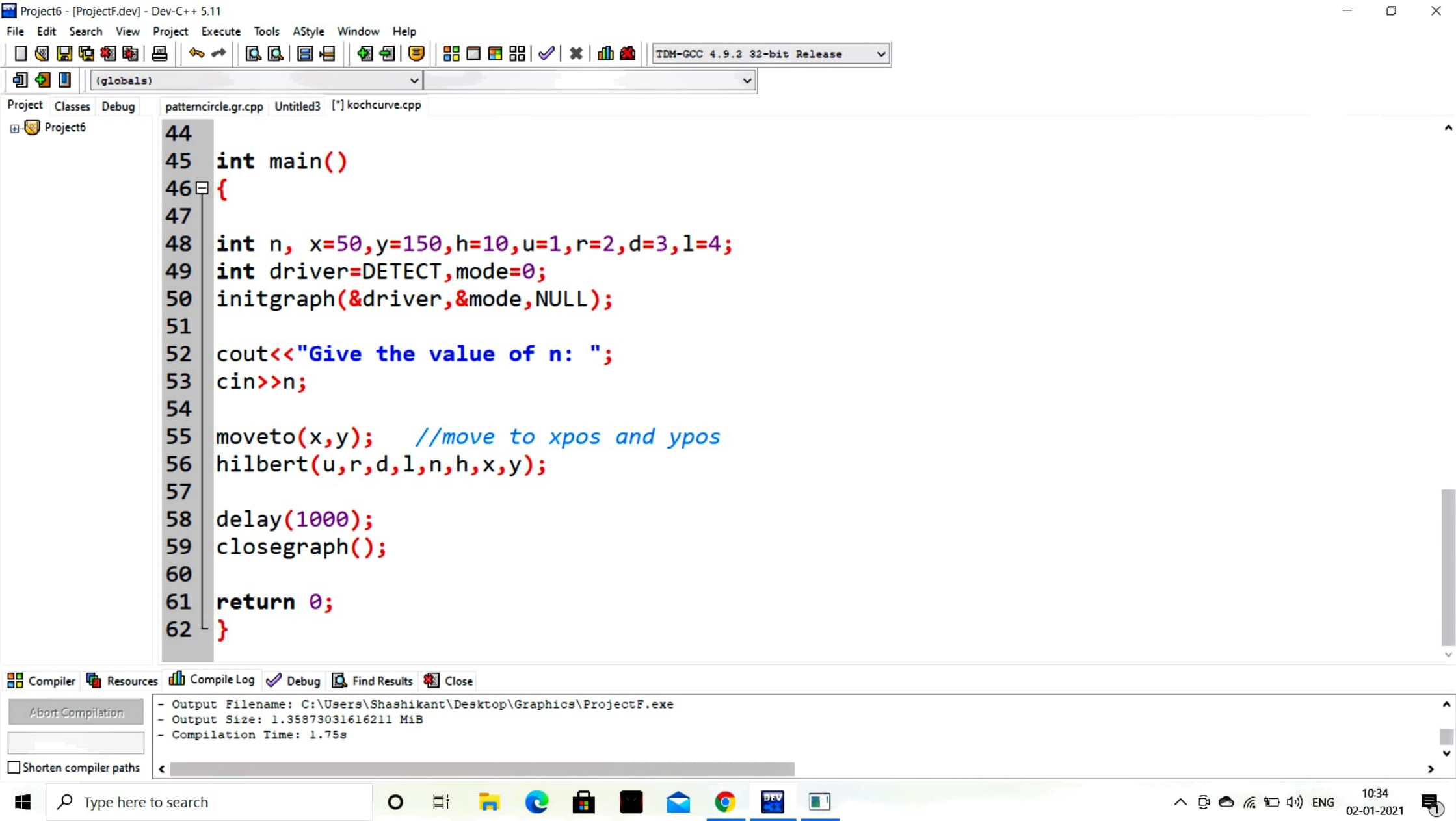


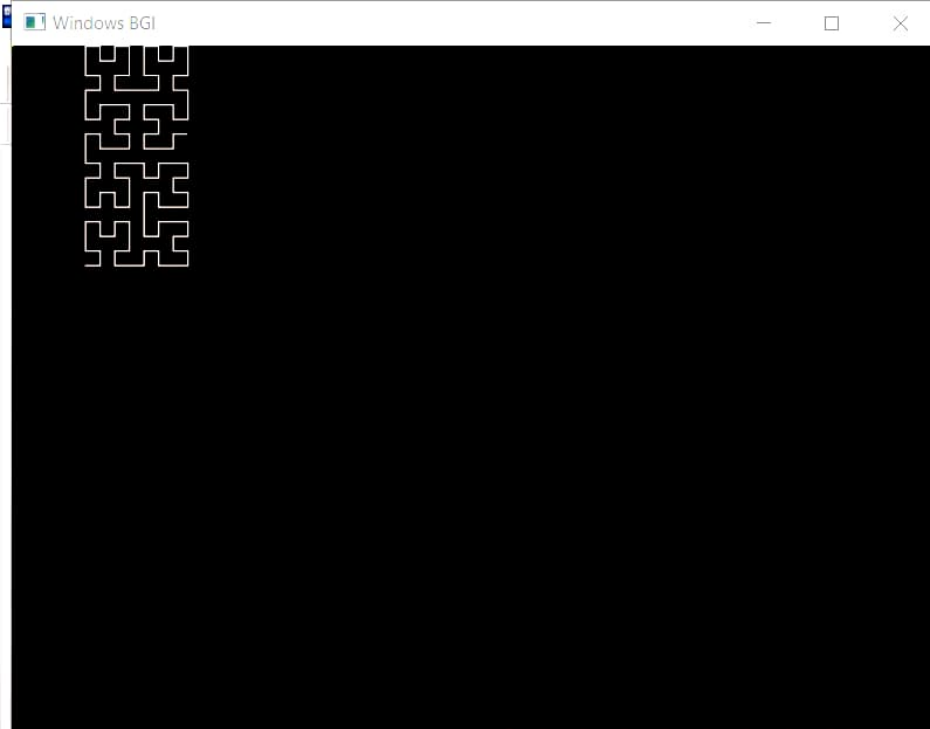


```
37
38     hilbert(1,d,r,u,i,h,x,y);
39     delay(1000);
40
41 }
42 }
43
44
45 int main()
46 {
47
48     int n, x=50,y=150,h=10,u=1,r=2,d=3,l=4;
49     int driver=DETECT,mode=0;
50     initgraph(&driver,&mode,NULL);
51
52     cout<<"Give the value of n: ";
53     cin>>n;
54
55     moveto(x,y); //move to xpos and ypos
56     hilbert(u,r,d,l,n,h,x,v);
```

Abort Compilation

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- Output Filename: C:\Users\Shashikant\Desktop\Graphics\ProjectF.exe
- Output Size: 1.35873031616211 MiB
- Compilation Time: 1.75s
```





```
130  
131 delay(1000);  
132 closegraph();  
133  
134 return 0;  
135 }
```

C:\Users\Shashikant\Desktop\Graphics\ProjectF.exe

Give the value of n: 4

Compiler Resources Compile Log Debug Find Results Close

Abort Compilation

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- Output Filename: C:\Users\Shashikant\Desktop\Graphics\ProjectF.exe  
- Output Size: 1.35873031616211 MiB  
- Compilation Time: 1.75s
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☐ Shorten compiler paths



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