

This folder contains three programs: Fibonacci Fractal, Filter Application and csv file sorting.

Fibonacci Fractal

Background

A Fibonacci word is defined through a concatenation of strings:

$f_1 = 1$

$f_2 = 0$

$f_3 = f_2f_1 = 01$

$f_4 = f_3f_2 = 010$

$f_5 = f_4f_3 = 01001$

...

$f_n = f_{n-1}f_{n-2}$

A Fibonacci fractal is defined on the plane by the following algorithm ($|f_n|$ is the number of digits in f_n)

Input: n

Compute:

n th Fibonacci word

 for each digit at position $k = 1, 2, \dots, |f_n|$

 draw a segment forward

 if digit is 0

 if k is even then turn left by 90 deg

 else turn right by 90 deg

Execute

This program will compute the graph of the Fibonacci fractal. If you would like to generate a graph with different inputs, you can change the "makefile.fib". In the makefile, there is something like

```
./ fib    7    10 10 10          100          100          fib7.bmp
```

Which means

`./ fib |fn| steps steps steps graph_width graph_height graph_filename`

*(Do not edit the space in the make file, just change the numbers)

To run:

In Linux or Ubuntu, go to the directory, run “make –f makefile.fib fib” then run “make –f makefile.fib runall”; then you can open the bmp files to check.

Filter Application

This program generates an output image from an input image by applying a filter in a kernel file.

To run:

In Linux or Ubuntu, go to the directory, run “make –f makefile.filter filter”; then run the command “convert -compress none input.jpg input.ppm” to convert the input image into ppm format; run “./filter input.ppm kernel output.ppm” to compute the output image in ppm format; then run “convert output.ppm ouput.jpg” to convert the output image into jpg format.

*(If your computer can open ppm image file directly, you don’t need to convert the output image in to jpg format; but you must convert the input image file in ppm format for the program to work. You can change the input image by replacing it with other photos. You can change the filter by changing the kernel file. Different kernel files of different filters can be searched on Google.)

The format of kernel is

n

scale

n rows of n numbers each

For example

1/9 [1 1 1]

[1 1 1]

[1 1 1]

Can be written in a kernel file by the following

3

9

1 1 1

1 1 1

1 1 1

CSV file sorting

This program reads the input file and outputs a CSV file with name sorted.csv with columns

city population country

where the rows are sorted in decreasing order by population.

To run:

In Linux or Ubuntu, compile the file by running “gcc cities.c” then run “./a.out” to execute the program. The output file “sorted.csv” is ready to be checked.