高等影像處理

作業#(1)

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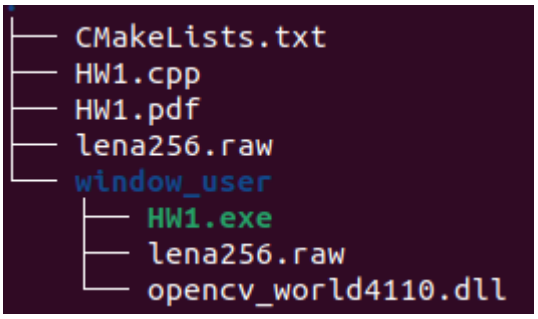
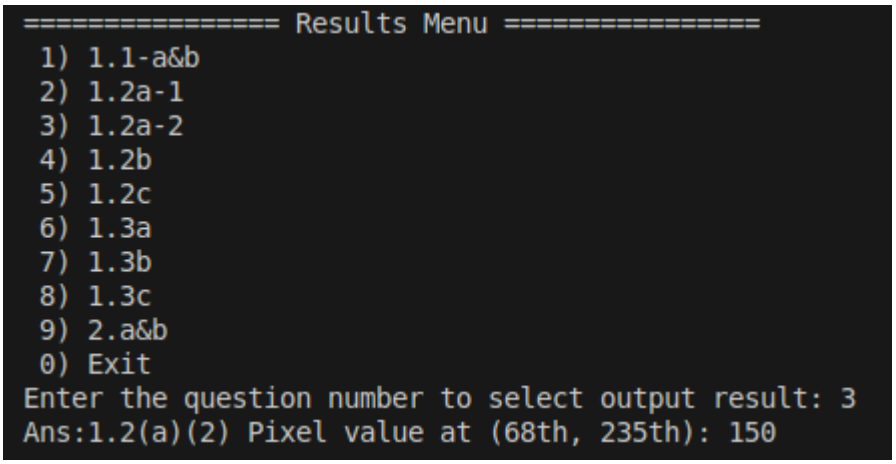
作業說明:



HW1.cpp主程式



輸入題號輸出答案, 圖像也會輸出至同路徑

使用ubuntu與VS Code進行開發,
使用opencv 4.5.4(sudo apt install libopencv-dev)
建置與執行:
cd HW1__114318047/
cmake -S . -B build
cmake --build build -j
./build/HW1

Window 執行
cd window_user
./HW1.exe

Window 建置執行:

1:Cmake:

winget install Kitware.CMake

2:OpenCV for window:

C:\opencv\build\x64\vc16\bin(make sure DLLs are in this dir)

3:Confirm CMake config file exists:

C:\opencv\build\x64\vc16\lib\OpenCVConfig.cmake

4:Build and run

cd "C:\HW1__114318047"

5:Configure:

cmake -S . -B build -G "Visual Studio 17 2022" -A x64
-DOpenCV_DIR="C:\opencv\build\x64\vc16\lib"

6:Produce exe:

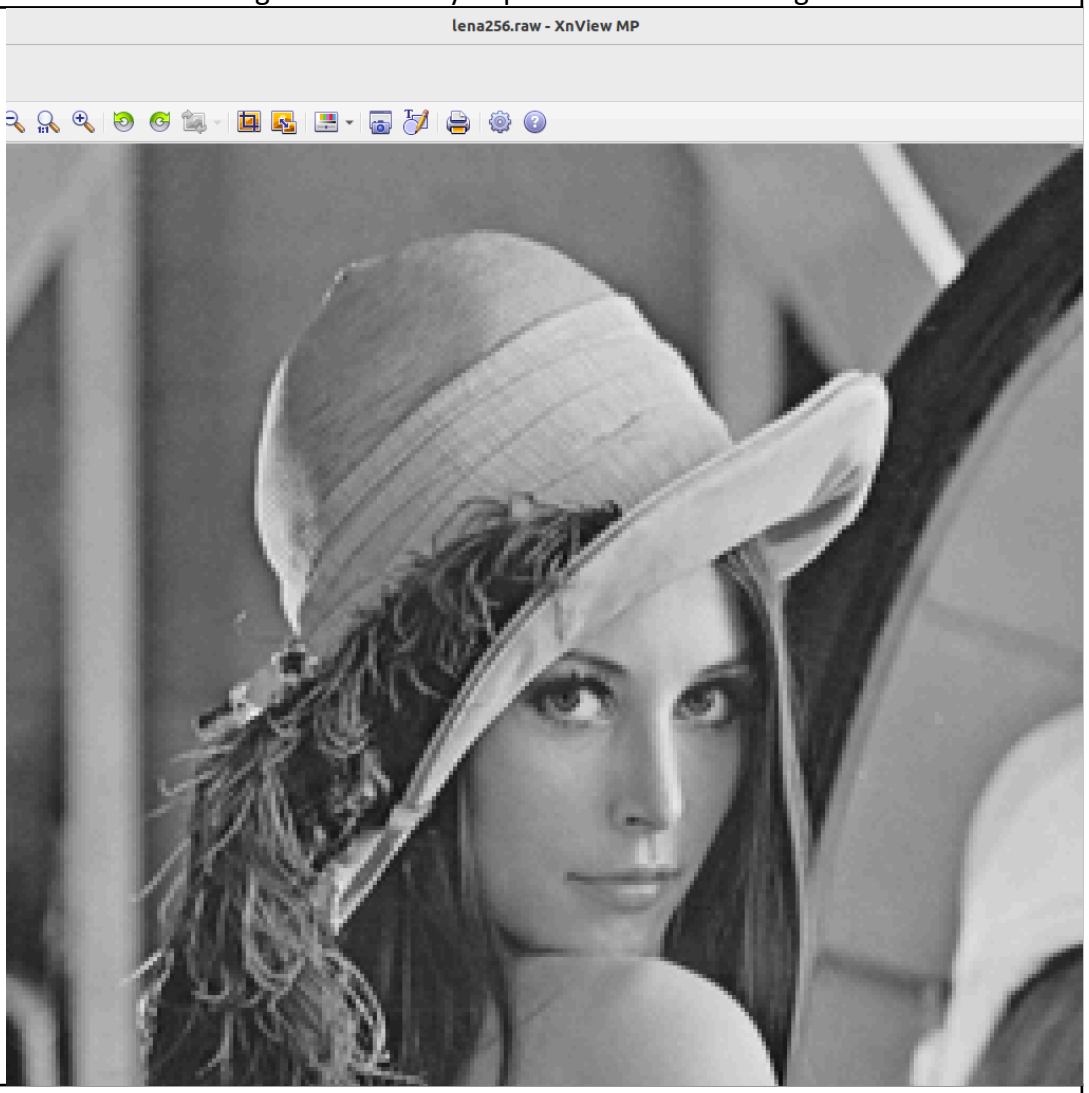
cmake --build .\build --config Release

7:Run exe

.\build\Release\HW1.exe

1.1a b

Find a raw image viewer that you prefer to read raw image lena256.raw



What options do you have to set to read the raw images correctly?

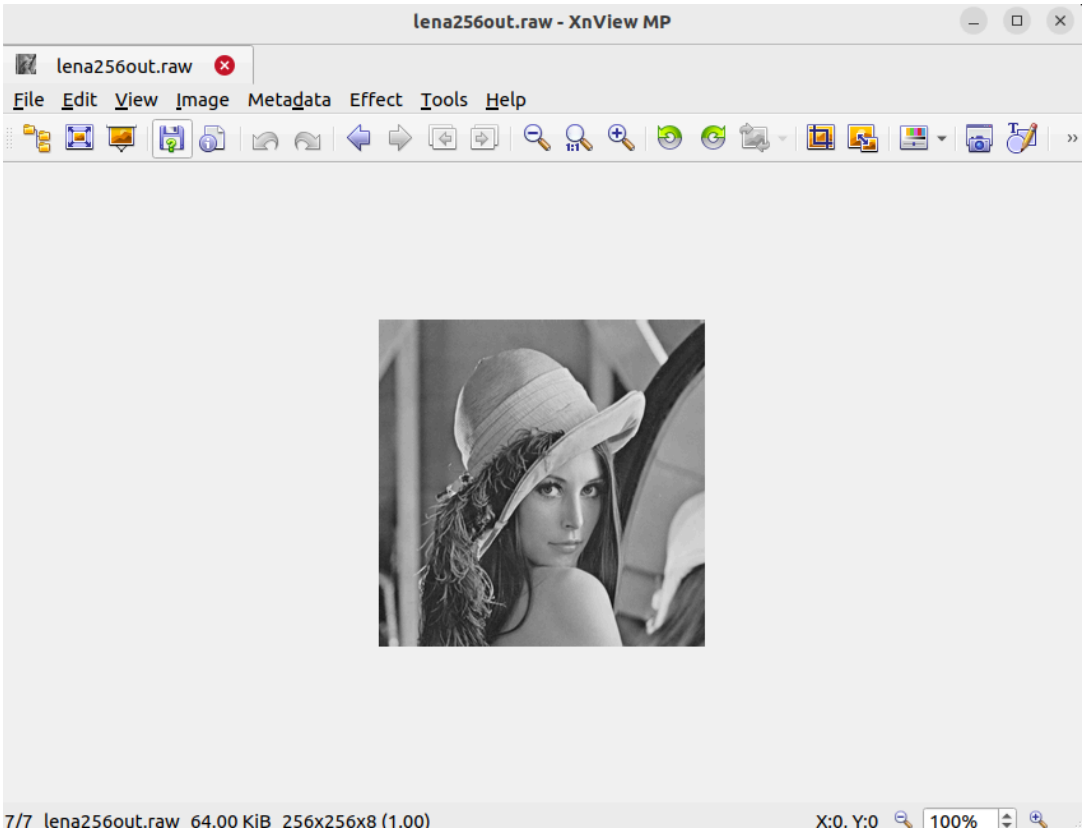
Set the resolution of image to 256x256, and grayscale also.
Since the size of image is 65536=256x256x1

1.2a(1)
Let the origin of pixel coordinate be the 0th row & 0th column located at the top of the left corner pixel of images, what is the intensity value of the pixel at the coordinate of the 70th row & 147th column?
`1.2(a)(1) Pixel value at (70th,147th):193`
Discussion (1.2a)(1)
圖像的最頂部(top left)為(0th,0th)，而圖像讀取的方式也是從0開始讀取，也就是說與題目定義相同，因此在求(70th,147th)時可直接使用fread(img_lena,1,size, input_file);的img_len進行讀取，並且題目為(70,147)，因此需要將(row,col)轉成index=row*width+col，並且使用img_lena(index)即可求得，答案為193。

1.2a(2)
What is the intensity value of the 17643th pixel stored in lena256.raw file? What is its pixel coordinate in the image
Ans:1.2(a)(2) Pixel value at (68th, 235th):150
Discussion (1.2a)(2)
圖像的最頂部(top,left)為(0th,0th)，index為1，因此在求(17643th)為index 17642，因此使用fread(img_lena,1,size,input_file);的img_len進行讀取，並且使用img_lena(index)即可求得，答案為150。

1.2b

Read lena256.raw and save as lena256_out.raw,correct result display in Xnview should be the same as below image



Discussion (1.2b)

定義char output_img[] = "lena256out.raw";，並且使用fopen開啟檔案，並使用”wb”(write　binary)，並且使用fwrite(img_lena,1,size,output_file)，此題學習到如何讀取且寫檔案，並且經驗證，讀取再寫取的圖片與原檔同。

1.2c

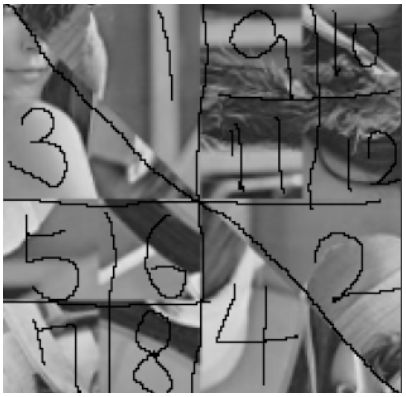
Divide lena256.raw into 4 triangular sub-blocks and 4 square sub blocks, and then flip or rotate and exchange the sub-blocks.The result should be the same as shown below.
Save and display the result.

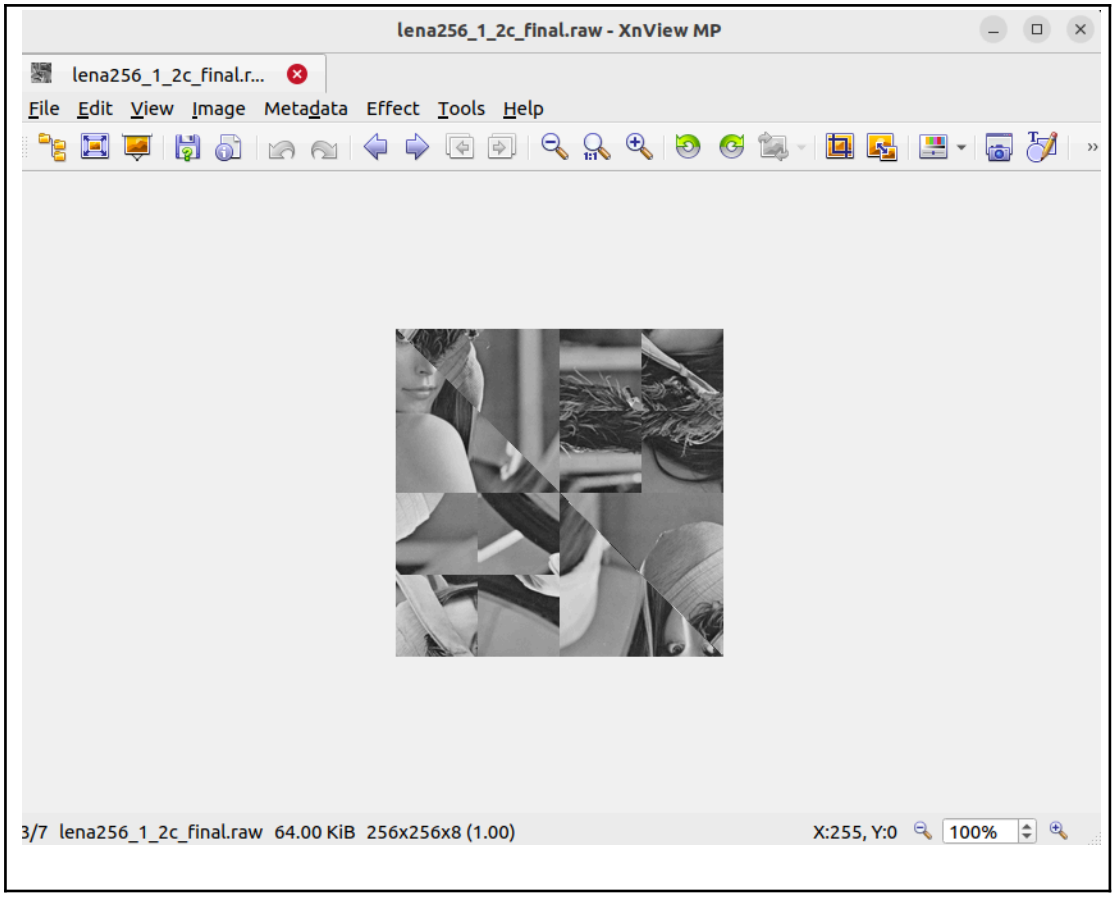
Discussion (1.2c)(2)

此題相當複雜，因為排列的結果沒有規律可尋，因此我將原圖切割成12個區塊且編號，並assign 12個buffer 存取，且觀察目標圖像的編號與原圖之間的關係。
在撰寫程式中定義許多小工具方便操作

1. Swap_blocks
   比如有兩個64x64的方塊要進行互換，定義block1的左上為(x1,y1),block2的左上為(x2,y2)，並且使用雙層for　loop將兩者各自讀取並存於buffer，並且再進行互換。
2. Rotate90cw_block
   將64x64的左上定義為(x,y)，並且從右上開始做寫入至buffer
   EX:
   (x,y) -> (x,y+64)
   (x,y+1) -> (x+1,y+64)
3. Rotate90ccw_block
   將64x64的左上定義為(x,y)，並且從右上開始做寫入至buffer
   EX:
   (x,y) -> (x+64,y)
   (x,y+1) -> (x+63,y+1)

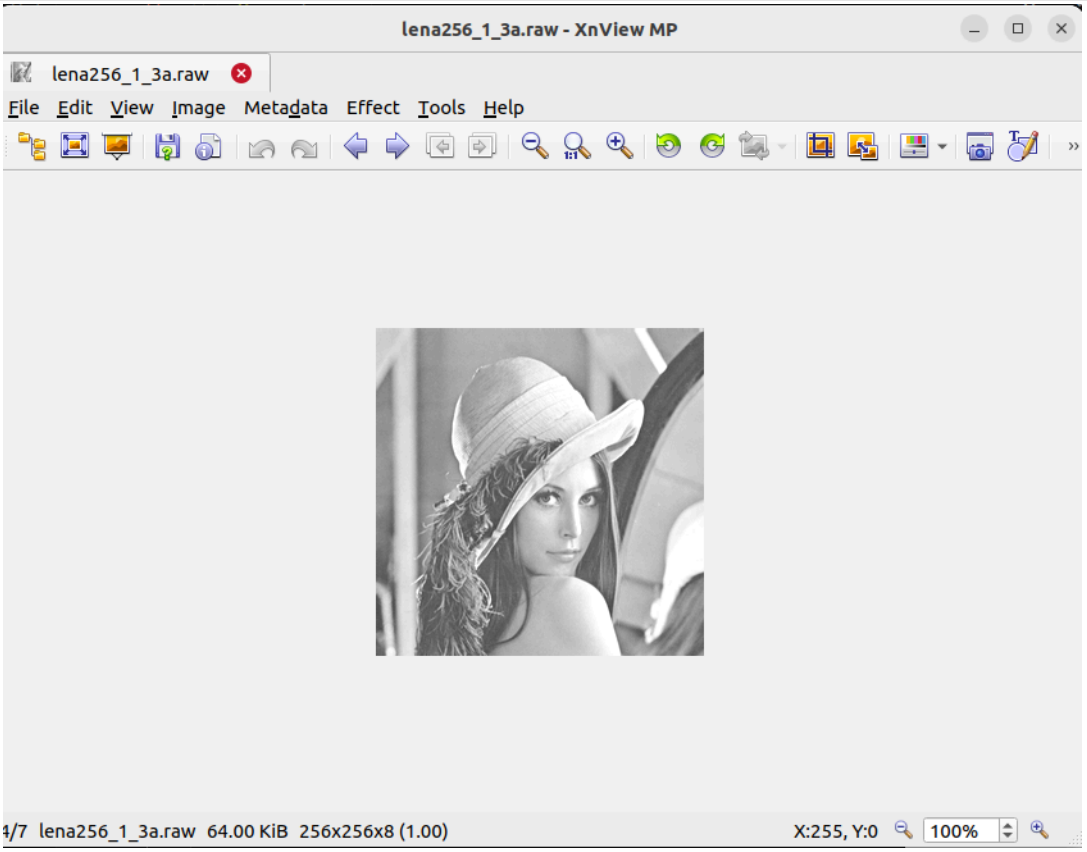
下圖為切割方法及編號及最後結果輸出




lena256_1_2c_final.raw - XnView MP
lena256_1_2c_final.r...
File Edit View Image Metadata Effect Tools Help
3/7 lena256_1_2c_final.raw 64.00 KiB 256x256x8 (1.00)
X:255, Y:0
100%

1.3a

Increase the image brightness.Reading lena256.raw and adding value 50 to each pixel value by C/C++.Write the output to a raw image file.Use Xnview to view the result.

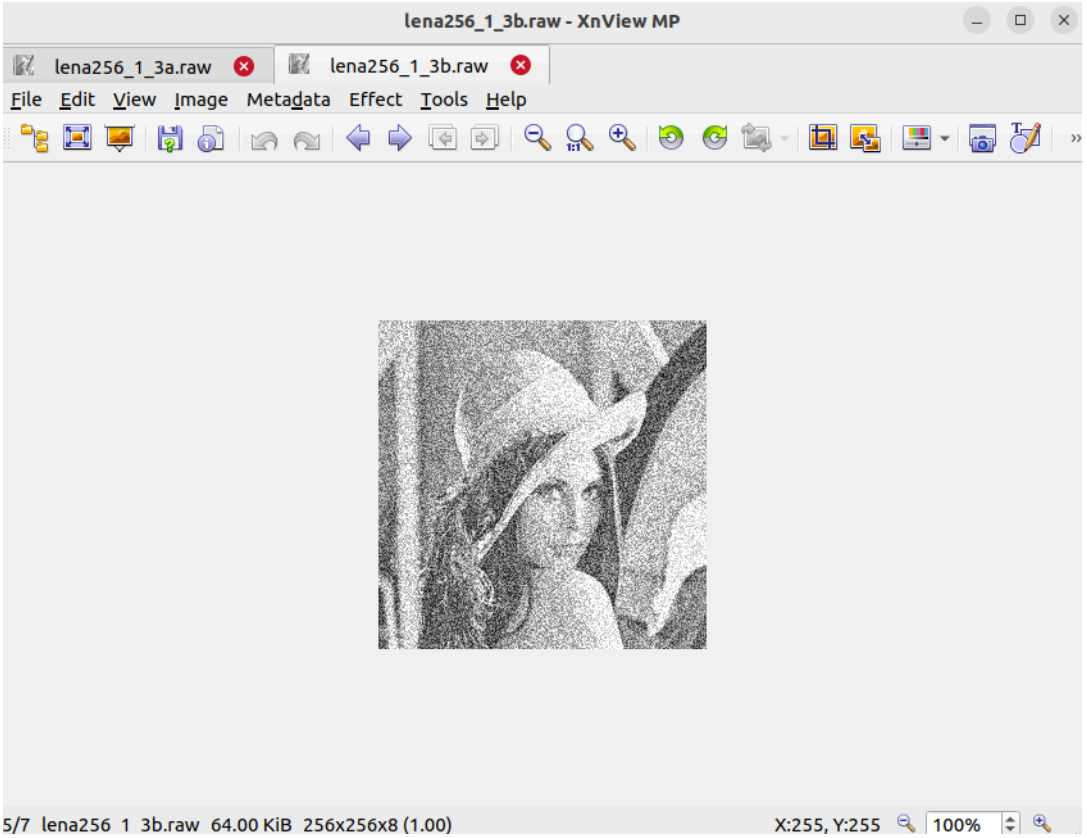


Discussion (1.3a)

此題需要將原圖讀取後，將每個像素點都加上50後顯示，因此我使用單一for loop並且判斷當前像素值是否大於等於205，如果成立，將該值直接付值為255，設定205的原因是因為如果設定判斷式的threshold為255的話，就會造成overflow的現象，即會造成該像素點為0(全黑)，因為溢位值，會由0開始計算

1.3b

Increase the image brightness.Reading lena256.raw and increase the image brightness with random value between -70 to 70.Use Xnview to view the result.



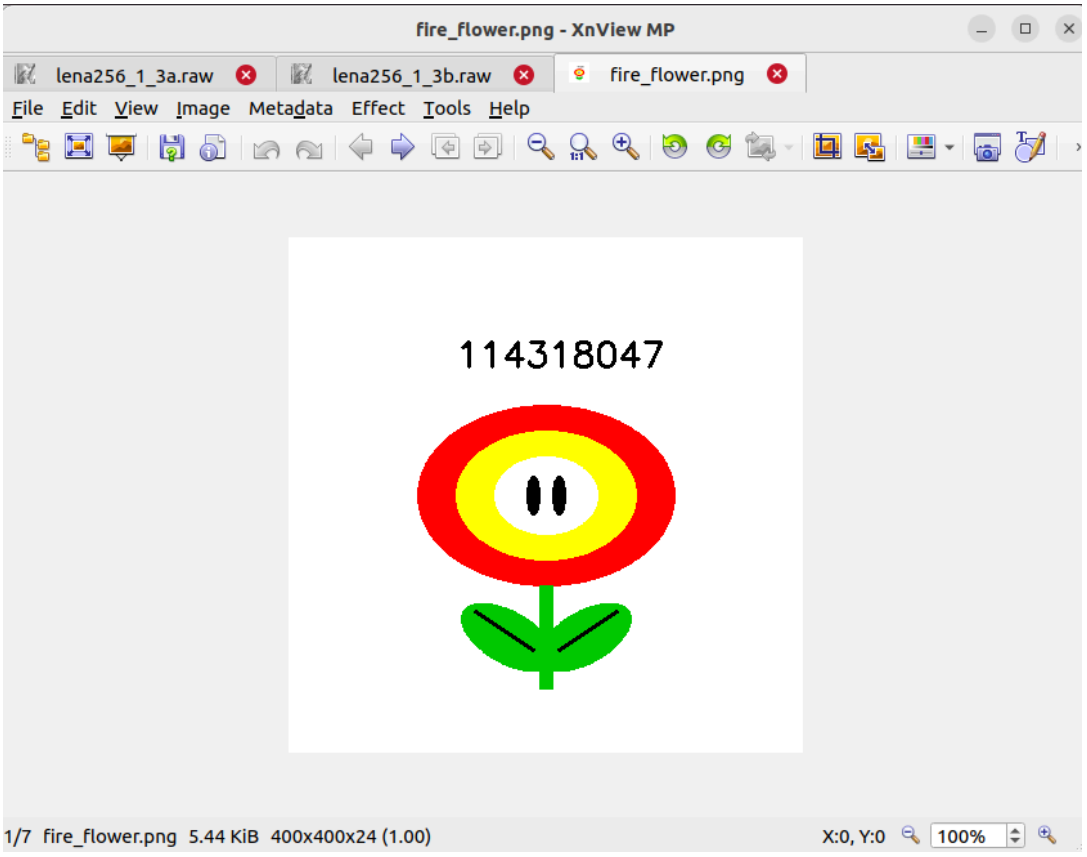
Discussion (1.3b)

此題需要加入介於-70 到70的雜訊至各像素中，並宣告暫存
int value = (int)img_lena[i] + random_value;
宣告暫存value為int因為這樣可以避免如果加入雜訊後造成overflow或underflow的情況發生。
並且在後方再進行clamping(value<0 0r value > 255)

1.3c
Which part you have to be careful?
Discussion (1.3c)
如在1.3(a)以及1.3(b)所說，像1.3a中加入50於像素值中須提前進行檢查，以避免overflow的情況發生，以像素值”205”作為threshold進行判斷，以可提前避免溢位。 在1.3(b)時則須注意overflow及underflow的情況發生，因此在clamping之前需要將暫存value以整數int進行宣告，避免加上雜訊後overflow或underflow int value = (int)img_lena[i] + random_value;

2. a & b

1.Review and be familiar with C/C++ programming language and setup the OpenCV environment according to installation guide “VS2022_OpenCV_SetupGuide.pdf”
2.Write a program to draw Fire Flower using OpenCV.



Discussion(2.a &b)

a.我是使用較為熟悉的IDE環境VS Code 與ubuntu進行開發，可省去設定環境所需的時間。
b.此題學習如何使用OpenCV於C++，使用Mat、ellipse、rectangle、line、putText等用法，並且成功將圖像畫出，並使用Xnview中顯示。