Programming Assignment 3: Image Reduction and Merge with Frame

Image reduction to quarterly size by selecting pixels of the even rows and even columns starting from row 0 (the bottom row) and column 0 (the left-most column). For example, if a 640×800 image is reduced to one-quarter size, it becomes a 320×400 image as blocked image of Figure 1(a). An image can be transformed mirror reflection vertically and horizontally as Figure 1(b) and Figure 1(c), respectively. Also, an image can be transformed mirror reflection centrally, as Figure 1(d), which is equivalent to a vertical mirror reflection followed by a horizontal mirror reflection or the other way around.

Figure 1. reduced image and its transformations

Suppose the same size of the original image is partitioned into four quadrants along the center lines in the vertical and horizontal direction. A framed merge transformation generates an image of merging the four reduced images in a fame is to place the quarterly reduced image on the top-left corner, the 2nd quadrant as region (a) in Figure 2, the vertical mirror reflection quarterly reduced image on the top-right corner, the 1st quadrant region as (b) in Figure 2, the the horizontal mirror reflection quarterly reduced image on the bottom-left corner, the 3rd quadrant as region (c) in Figure 2, and the centrally mirror reflection quarterly reduced image on the bottom-right corner, the 4th quadrant as region (d) in Figure 2. A frame surrounds the merged figures and split the figures in the horizontal and vertical direction. The width of the frame is input by the user.

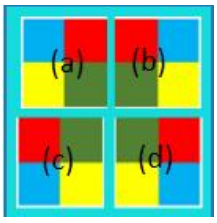

Figure 2: merged image with a frame

Write a C program to perform the following steps:

a. Read a color image bitmap file from disk.
b. Input the size (width) of a frame between 4 and 20 in the unit of pixel and input the RGB value of the frame color.
c. Output the file header and the image information head of the input image on the screen.
d. Perform the quarterly reduction transformation.
e. Write the image bitmap file of the reduced image to disk and output its file header and the image information head on the screen.
f. Perform the frame merge transformation of the reduced image and its reflected images as in Figure 2.
g. Write the image bitmap file of the frame merged image to disk and output its file header and the image information head on the screen.

Use file name **assgn3_DXXXXXXX.c** for the source code. Write a report, **report3_DXXXXXXX.pdf**, to explain how you develop your assignment solution, where **DXXXXXXX** is your student ID. Homework assignment 2 is due by **23:59 pm, Wednesday, April 10**. Submit two files **assgn3_DXXXXXXX.c** and **report3_DXXXXXXX.pdf** to **iLearn**.

The followings are images of an execution example with frame size 10 and RGB value (20, 220, 220) of the frame color.

Input image: **abraham_lake.bmp**

Reduced image: **abraham_lake_reduced.bmp**

Merged image with frame size 10 and RGB value (20, 220, 220):
abraham_lake_frame_merged.bmp

Program execution example:

```
Enter the size of frame in pixel (between 4 and 20): 10

Enter RGB value of the frame color: 20 220 220

>>>> File header of the input image, abraham_lake.bmp:

Type:             BM
Size:             1080054
Resserved:
OffsetBits:       54
InfoSize:         40
Width:            800
Height:           450
Planes:           1
BitPerPixel:      24
Compression:      0
ImageSize:        1080000
XResolution:      5669
YResolution:      5669
Colors:           0
ImportantColors:  0
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>>>> File header of the reduced image, abraham_lake_reduced.bmp:

Type:             BM
Size:             270054
Resserved:
OffsetBits:       54
InfoSize:         40
Width:            400
Height:           225
Planes:           1
BitPerPixel:      24
Compression:      0
ImageSize:        270000
XResolution:      5669
YResolution:      5669
Colors:           0
ImportantColors:  0
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>>>> File header of the frame merged image, abraham_lake_frame_merged.bmp:

Type:             BM
Size:             1196214
Resserved:
OffsetBits:       54
InfoSize:         40
Width:            830
Height:           480
Planes:           1
BitPerPixel:      24
Compression:      0
ImageSize:        1196160
XResolution:      5669
YResolution:      5669
Colors:           0
ImportantColors:  0
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```