

## PS1b: LFSR - PhotoMagic

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For this portion of the assignment, you will:

- Write a C++ program to read three arguments from the command line: source image filename, output image filename, and FibLFSR seed.
- Use SFML to load the source image from disk and display it in its own window.
- Use your debugged FibLFSR class to encode (or decode) the image.
- Display the encoded/decoded image in its own window.
- Save the new image to disk.

Average time to complete the assignment ~6 hours.

### Details

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Please see starter code [pixels.cpp](#) for using SFML to load, manipulate, display, and save an image.

The code reads in a file and then uses individual pixel access to photographically negate an upper 200 px (pixels) square, like this:



Your task is to write a program PhotoMagic.cpp that can encrypt and decrypt pictures, by implementing the following API:

#### ■ *Transform function.*

The `transform()` function takes an image and an `FibLFSR` as arguments. It transforms image using the linear feedback shift register as follows:

For each pixel (x, y), in row major order — (0, 0), (0, 1), (0, 2), ... — extract the red, green, and blue components of the color (each component is an integer between 0 and 255). Then, XOR the red component with a newly-generated 8-bit integer. Do the same for the green (using another new 8-bit integer) and, finally, the blue. Create a new color using the result of the XOR operations, and set the pixel in the new picture to that color.

```
// transforms image using FibLFSR
void transform( sf::Image&, FibLFSR*);
```

```
// display an encrypted copy of the picture, using the LFSR
// to do the encryption
int main(int argc, char* argv[])
```

■ Main function.

The `main()` function takes three command-line arguments: an input picture filename, an output picture filename, and a binary password (the initial LFSR seed). It should display the transformed picture on the screen.

Your main code should be in a file named `PhotoMagic.cpp` and should accept command line arguments as follows (e.g.):

```
% PhotoMagic input-file.png output-file.png 1011011000110110
```

which should take the input file and encrypt it using the method described above, with `FibLFSR` seed `1011011000110110`.

Your program should display the source file and encrypted file, and write out the encrypted file to `output-file.png`. Note: If you save as a JPG, you won't be able to restore the file properly. (Why not?)

Then, if you re-run your program on the encrypted file, and give it the same LFSR seed and tap, it should produce the original input file! (Make sure you understand why.)

Make sure to transform the **whole** image, not just the upper-left  $200 \times 200$  pixels square from the demo above. You can have 1 or 2 output windows.

*Note:* to work with two SFML windows, create two window objects (e.g., `window1` and `window2`), you can use this as your event loop:

```
while (window1.isOpen() && window2.isOpen()) {
    sf::Event event;
    while (window1.pollEvent(event)) {
        if (event.type == sf::Event::Closed)
            window1.close();
    }
    while (window2.pollEvent(event)) {
        if (event.type == sf::Event::Closed)
            window2.close();
    }
    window1.clear();
    window1.draw( /* fill in here */ );
    window1.display();
    window2.clear();
    window2.draw( /* fill in here */ );
    window2.display();
}
```

## What to turn in

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- code files `PhotoMagic.cpp`, `FibLFSR.cpp`, and `FibLFSR.h` plus your `Makefile`
- two screenshots: one showing the encryption process (`encode.png`) and the other showing decryption (`decode.png`), and
- a `ps2b-readme.txt` with: name, statement of the functionality of your program (e.g., fully works, or explanation of partial functionality). Optional: any other notes
- The executable file that your `Makefile` builds should be called `PhotoMagic`.

### How to turn it in

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Submit on Blackboard.

## Grading rubric

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Feature	Value	Comment
core implementation	8	full & correct implementation = 8 pts; nearly complete = 6pts; part way = 4 pts; started = 2 pt must parse command line arguments properly (2 pts)
screenshots	2	must show both original and encrypted <b>whole</b> image and then encrypted and decrypted image
Makefile	2	Makefile included targets <code>all</code> and <code>clean</code> must exist <code>all</code> should build <code>PhotoMagic</code> must have dependencies correct
ps2b-readme.txt	2	
<b>Total</b>	<b>14</b>	

### Extra credit

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If you're looking for a bigger challenge, consider converting from an alphanumeric password to the LFSR initial seed (2 extra points)

If you do any of the extra credit work, make sure to describe exactly what you did in `ps2b-readme.txt`.