CS202 -- Lab 3

- **CS202 -- Data Structures**
- **Fall, 2021**
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- **http://web.eecs.utk.edu/~jplank/plank/classes/cs202/Labs/Lab3**
- **Lab Directory: /home/plank/cs202/Labs/Lab3**

Back to PGM files.

The structure of this lab is like the structure of the lecture notes on Classes, Header/Source/Object/Executable Files. What I want you to do is the following, in the directory in which you are working:

```
UNIX> cp -r /home/jplank/cs202/Labs/Lab3/src .
UNIX> cp -r /home/jplank/cs202/Labs/Lab3/include .
UNIX> cp -r /home/jplank/cs202/Labs/Lab3/pgm .
UNIX> cp /home/jplank/cs202/Labs/Lab3/makefile .
UNIX> mkdir obj
UNIX> mkdir bin
```

You will now have five directories: **include**, **src**, **obj** **bin** and **pgm**. The first four mirror the lecture notes, and the last has pgm files that you can use for testing. In **include/pgm.hpp**, there is a definition of a PGM class. The description of the class is in the include file, so go ahead and read it:

```
/* Header file to define the PGM class, that lets you manipulate PGM files.
   The files themselves are simply stored in a vector of vectors of ints.
   All of the methods return true if they succeed and false if they fail.

   Write() needs to produce files in a specific format:

      - P2 on its own line, no spaces.
      - cols rows on the next line, separated by a space, no additional spaces
      - 255 on its own line, no spaces.
      - Then the pixels: 20 pixels per line, one space between pixels, no additional spaces.
      - You don't print additional newlines at the end of each row of pixels -- just
        start the next row of pixels.
      - The last line is the only one that can have fewer than 20 pixels.
      - To give an example, if the picture has two rows and 11 columns, and all of the
        pixels have values of 5, then the pixels will look like:

5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
5 5
 */

#pragma once

#include <vector>

class Pgm {
  public:
    bool Read(const std::string &file);           // Reads a PGM file
    bool Write(const std::string &file) const;    // Writes a PGM file
    bool Create(size_t r, size_t c, size_t pv);   // Creates a rxc PGM with the given pixel value
    bool Clockwise();                             // Rotates 90 degrees clockwise
    bool Cclockwise();                            // Rotates 90 degrees counterclockwise
    bool Pad(size_t w, size_t pv);                // Adds a border of w pixels with the given value
    bool Panel(size_t r, size_t c);               // Makes rxc copies of the PGM
    bool Crop(size_t r,    size_t c,
              size_t rows, size_t cols);         // Crops from r:c to (r+rows):(c+cols)
  protected:
    std::vector < std::vector <int> > Pixels;
};
```

This is all straightforward. Your job in this lab is to implement all of the methods, with the exception of **Read**(), which is already written for you in **src/pgm.cpp**. Pay attention to the format of **Write**(), which is specified in the opening comments at the beginning of the file.

As in the Tic-Tac-Toe lecture, there is a separate testing program, in **src/pgm_tester.cpp**. I'm not going to include it here because it is so straightforward. The testing program allows you to test each method:

```
UNIX> echo '?' | bin/pgm_tester
usage: pgm_editor [prompt] - commands on standard input

        READ filename             - Read the PGM file
        WRITE filename            - Write the stored PGM to the file
        CREATE rows cols pixvalue - Call Create()
        CW                        - Call Clockwise()
        CCW                       - Call Cclockwise()
```

```
        PAD pixels pixvalue        - Call Pad()
        PANEL r c                  - Call Panel()
        CROP r c rows cols         - Call Crop()
        Q                          - Quit
        ?                          - Print commands
UNIX>
```

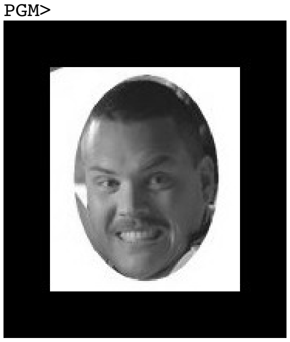
The **makefile** allows you to compile everything, putting object files in the **obj** directory, and putting the binary in **bin/pgm_tester**. Let me give you some examples. Under each example, I have the picture that is created:

```
UNIX> bin/pgm_tester 'PGM>'
PGM> CREATE 50 200 0
PGM> WRITE pgm/example_create.pgm
PGM>
```

```
PGM>
PGM> READ pgm/Red.pgm
PGM> CW
PGM> WRITE pgm/example_cw.pgm
PGM>
```

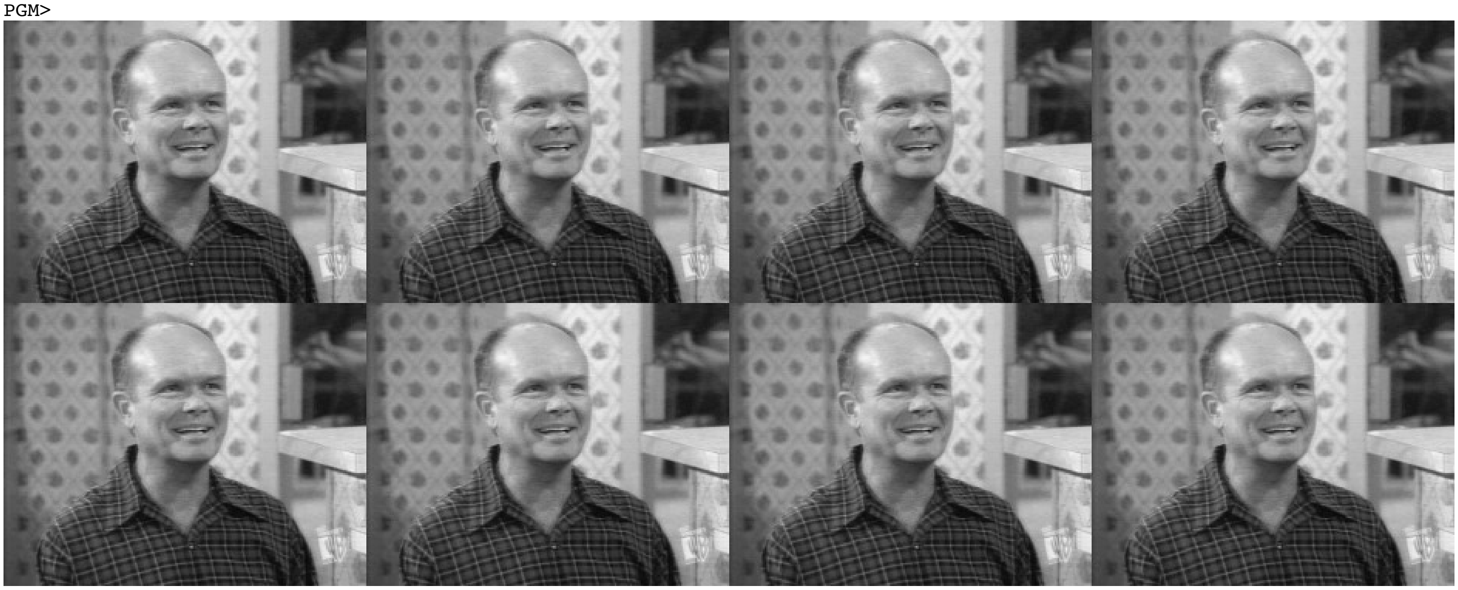
```
PGM>
PGM> READ pgm/Red.pgm
PGM> CCW
PGM> WRITE pgm/example_ccw.pgm
PGM>
```

```
PGM>
PGM> READ pgm/Rodney.pgm
PGM> PAD 30 0
PGM> WRITE pgm/example_pad_1.pgm
PGM>
```



```
PGM>
PGM> PAD 30 255
PGM> PAD 1 0
PGM> WRITE pgm/example_pad_2.pgm
PGM>
```

```
PGM>
PGM> READ pgm/Red.pgm
PGM> PANEL 2 4
PGM> WRITE pgm/example_panel_1.pgm
PGM>
```



```
PGM>
PGM> READ pgm/Rodney.pgm
PGM> PAD 6 0
PGM> PAD 3 255
PGM> PANEL 3 5
PGM> WRITE pgm/example_panel_2.pgm
PGM>
```

```
PGM>
PGM> READ pgm/Red.pgm
PGM> CROP 45 60 50 100
PGM> WRITE pgm/example_crop.pgm
PGM>
```

```
PGM>
PGM> READ pgm/Red.pgm
PGM> CROP 45 60 50 100
PGM> PAD 2 0
PGM> PAD 1 255
PGM> PANEL 4 9
PGM> WRITE pgm/example_crop_panel.pgm
PGM>
```

```
PGM>
PGM> Q
UNIX>
```

Grading and Starting

To start this lab -- ***and do this during lab***, write dummy versions of the methods that don't work, but that compile when you type **make**. That way you can make **bin/pgm_tester**, and you can start writing code and testing. I would do **Write()** first, and then do the rest in whatever order you want.

The gradescript assumes that you program is in **bin/pgm_tester**

The only think you should submit is **src/pgm.cpp**.

BTW, in 2019, the TA's Kody Bloodworth and ChaoHui Zheng wrote up some supplementary information. I have linked it [here, in the file Supplement.pdf](Supplement.pdf).