

cs805 Assignment 2

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Abstract

This assignment is written in literate programming style, generated by noweb, rendered by LaTeX, and compiled by clang++ with c++11 standard.

assignment paper is at latex/as2.pdf

c++ programs are at src/*

binary executable for OS X 10.8 is inside bin

1 function implementation

```
<<src/util.cpp>>=
#include "util.h"
#include <math.h>

ImagePanel foreach_pixel_exec(ImagePanel empty_img, std::function<int(float)> ray_
    for (auto& pixel: empty_img) { //foreach pixel in empty_img
        //std::cout<<"before: "<<pixel<<std::endl;
        pixel = ray_func(1.0);
        //std::cout<<"after: "<<pixel<<std::endl;
    }
    return empty_img;
}

//initialize img panel to all 0s
ImagePanel init_img_panel(ImagePanel img) {
    for (auto& pixel: img) { //foreach pixel in empty_img
        pixel = 0;
    }
    return img;
}

//translate ray equation to an 0~255 shading value
int ray_tracing(Ray ray) {
    Point p = ray_objects_intersection(ray);
    return ray[0]+ray[1]+ray[2]+ray[3];
}

//calculate the ray object intersection point
Point ray_objects_intersection(Ray ray) {
    return {1,2,3};
}

//=====helpers=====

//Translate 2D array index of row column to 1D index.
```

```

//Notice that x, or column index, starts with 0.
//If return value is -1 then there is an out-of-bounce error.
int to_1d(int x, int y) {
    if (x >= IMG_X || x < 0)
        return -1;
    if (y >= IMG_Y || y < 0)
        return -1;
    return (IMG_Y*y + x);
}

//Translate 1d array index to 2d
std::array<int, 2> to_2d(int x) {
    if (x>=(IMG_X*IMG_Y) || x < 0) {
        return {-1,-1};
    }
    int y_ = x / IMG_X;
    int x_ = x % IMG_X;
    return {x_, y_};
}

//prints the img panel
void print_img_panel(ImagePanel img) {
    std::cout<<std::endl;
    for (auto& pixel : img) {
        std::cout<<pixel<<" ";
    }
    std::cout<<std::endl<<"Array size: "<<img.size()<<std::endl;
}

@

```

2 header

Here is an header file for typedefs and function declarations.

```
<<src/util.h>>=
```

```

#ifndef UTIL_H
#define UTIL_H

//define global vars
#define IMG_X 512
#define IMG_Y 512
#define IMG_LEN ( IMG_X * IMG_Y )

#include <array>
#include <functional>
#include <iostream>
typedef std::array<int, IMG_LEN> ImagePanel;
typedef std::array<float, 3> Point;
typedef std::array<float, 4> Ray;//assuming there are 3 parameters for ray equation

ImagePanel foreach_pixel_exec(ImagePanel, std::function<int(float)>);
ImagePanel init_img_panel(ImagePanel);
int ray_tracing(Ray);
Point ray_objects_intersection(Ray);

//helpers
int to_1d(int, int);
std::array<int, 2> to_2d(int);
void print_img_panel(ImagePanel);
#endif
@

```

3 main funciton

```

<<src/main.cpp>>=
#include <iostream>
#include <typeinfo>//debugging only
#include "util.h"

int main () {
    ImagePanel resultImg;

```

```

resultImg = init_img_panel(resultImg);
resultImg = foreach_pixel_exec(resultImg, [](float x){return ray_tracing({x,x,x},
print_img_panel(resultImg);

//unit tests
std::cout<<to_1d(0, 1)<<std::endl;
std::cout<<to_2d(512) [0]<<std::endl;
std::cout<<to_2d(512) [1]<<std::endl;
std::cout<<to_1d(1, 1)<<std::endl;
std::cout<<to_2d(513) [0]<<std::endl;
std::cout<<to_2d(513) [1]<<std::endl;
std::cout<<to_1d(511, 1)<<std::endl;
std::cout<<to_2d(1023) [0]<<std::endl;
std::cout<<to_2d(1023) [1]<<std::endl;
std::cout<<to_1d(512, 1)<<std::endl;
std::cout<<to_2d(512*512) [0]<<std::endl;
std::cout<<to_2d(512*512) [1]<<std::endl;
return 0;
}
@

```

4 compile script

Furthermore, this is the command to link these files. Notice that I am using -std=c++11 flag to enable c++ 11 features. The output binary executable is bin/run

```

<<compile.sh>>=
clang++ -std=c++11 -stdlib=libc++ -o bin/run src/main.cpp src/util.cpp
@

```