Laboratoire d'Informatique Graphique et Géométrique

Introduction to Computer Graphics
Exercise 1 – 2D transformations and GLSL

Handout date: 28.02.2017

Submission deadline: 09.03.2017, 13:00 h

What to hand in

A .zip compressed file renamed to hw*n*-GroupMemberNames.zip where *n* is the number of the current exercise sheet. It should contain:

- Hand in **only** the source code - *do not submit the build files or executable.* You'll lose 0.5 points if you include build CMakeFiles, etc. (See example submission at the end of this document).
- A `readme.txt` file containing a brief description on how you solved each exercise (use the same numbers and titles) and the encountered problems.
- Other files that are required by your `readme.txt` file. For example, if you mention some screenshot images in `readme.txt`, these images need to be submitted too.
- Submit your solutions to Moodle before the submission deadline. Late submissions will receive 0 points!

Goal

In this exercise you will implement the following tasks:

- Use 2D transformations to create an interesting spiral pattern;
- Manipulate texture coordinates to produce a checkerboard;
- Create a simplified solar system simulation;
- (bonus) create a small Arkanoid © game (your grade saturate at 6);

1.1 Triangle Spirals (2 points)

In this part of the homework your goal is to create spiral patterns with triangles by using simple 2D transformations. You should provide 2 different versions; the first one is a simple spiral with triangles (see Figure 1 left) and the second should be Fermat's spiral (see Figure 1 right). Please provide an easy way to switch between the 2 versions (for example an `if` statement with a constant at the beginning of your program). For informations about Fermat's spiral formula, please check this wikipedia article.

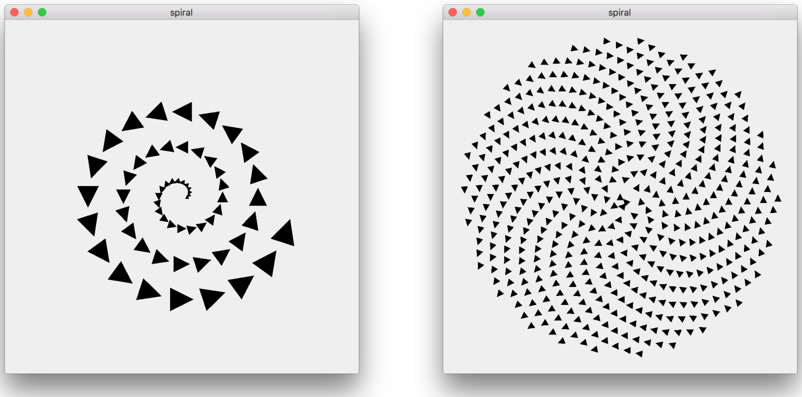


Figure 1: (left) simple spiral. (right) Fermat's spiral

All your code should be in the `Display()` function in `main.cpp`. *Note that you can call* `triangle.Draw(model)` *several time to draw more than one triangle.* Your results should be very similar to Figure 1.

1.2 Checkerboard (2 points)

In this part of the homework your goal is to create a checkerboard pattern by modifying a GLSL shader. The shader receives a 1D texture, called `colormap`, with 3 colors (think of it as a one dimensional array). Your job is to compute the texture coordinates creating the checkerboard pattern on the square. You results should be very similar to Figure 2.

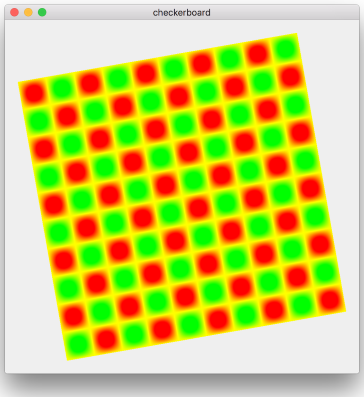


Figure 2: The checkerboard you need to produce.

1.3 Solar System (2 points)

In this third part, your job is to create and animate a small simplified solar system with all the following requirements:

- The sun should rotate on itself.
- The earth should have an ellipsoidal trajectory around the sun and rotate on itself.
- The moon should rotate around the earth and on itself.
- Create an ”accelerated” reality (you can have a parameter to tweak the speed).

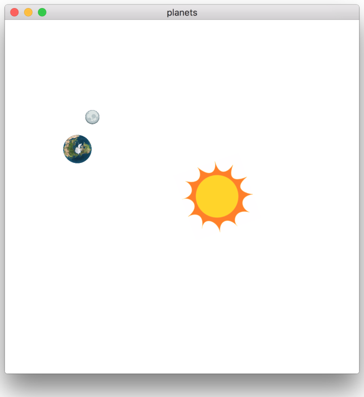


Figure 3: The solar system you need to produce.

In C++ you can use the following function to recover the current time (you may find it useful): `float time_secs = glfwGetTime();`

1.4 Arkanoid (2 bonus points)

In this bonus exercise, we ask you to create a simple *Arkanoid* © game. Be creative ! Remember that the number of points you may receive for this graded homework saturates at 6.

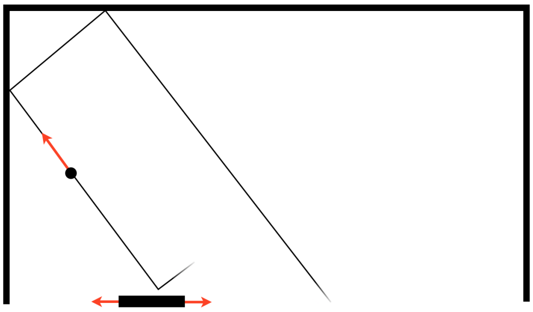
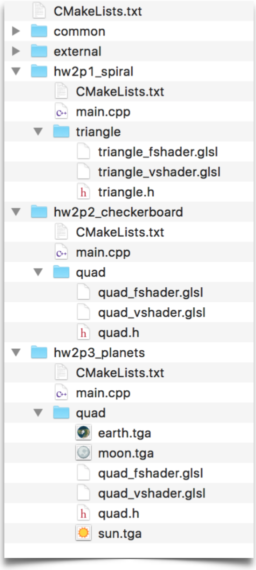


Figure 4: Simple illustration of what your game could look like.

2 Submission Guidelines

Structure of your submission

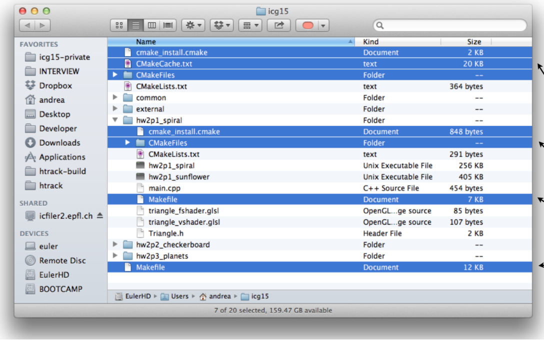
```
// your code should run using the following commands
// on the lab machine (INF3) !!
~/icg17: mkdir build
~/icg17: cd build
~/icg17/build: cmake ..
~/icg17/build: make
~/icg17/build: cd hw2p1_spiral/
~/icg17/build/hw2p1_spiral: ./hw2p1_spiral
```



```
CMakeLists.txt
▶ common
▶ external
▼ hw2p1_spiral
    CMakeLists.txt
    main.cpp
  ▼ triangle
      triangle_fshader.glsl
      triangle_vshader.glsl
      triangle.h
▼ hw2p2_checkerboard
    CMakeLists.txt
    main.cpp
  ▼ quad
      quad_fshader.glsl
      quad_vshader.glsl
      quad.h
▼ hw2p3_planets
    CMakeLists.txt
    main.cpp
  ▼ quad
      earth.tga
      moon.tga
      quad_fshader.glsl
      quad_vshader.glsl
      quad.h
      sun.tga
```

This mostly happens to people that didn't fully understand the concept of **out-of-source build** (see example)

```
/// An example of a not out-of-source build
~: unzip -qq -o hw2-Tagliasacchi-Lienhard-Deng.zip
~: cd icg17
~/icg17: cmake .
~/icg17: make
```



Name	Kind	Size
cmake_install.cmake	Document	2 KB
CMakeCache.txt	text	20 KB
▶ CMakeFiles	Folder	--
CMakeLists.txt	text	364 bytes
▶ common	Folder	--
▶ external	Folder	--
▼ hw2p1_spiral	Folder	--
cmake_install.cmake	Document	848 bytes
▶ CMakeFiles	Folder	--
CMakeLists.txt	text	291 bytes
hw2p1_spiral	Unix Executable File	256 KB
hw2p1_sunflower	Unix Executable File	405 KB
main.cpp	C++ Source File	454 bytes
Makefile	Document	7 KB
triangle_fshader.glsl	OpenGL...ge source	85 bytes
triangle_vshader.glsl	OpenGL...ge source	107 bytes
Triangle.h	Header File	2 KB
▶ hw2p2_checkerboard	Folder	--
▶ hw2p3_planets	Folder	--
Makefile	Document	12 KB

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7 of 20 selected, 159.47 GB available

these are the build files **you should not submit**. (Why? If we decide to compile your code we have to manually delete them one by one!!!)