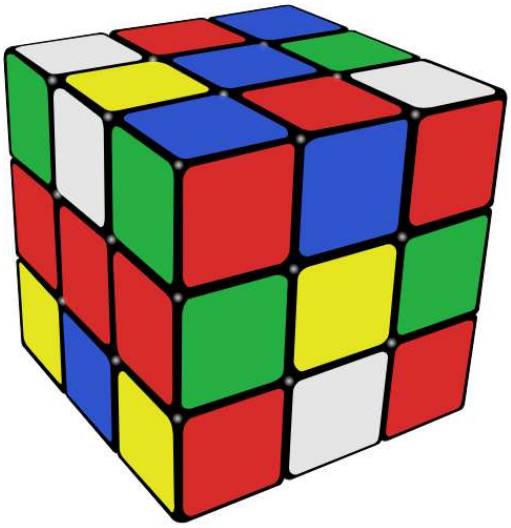
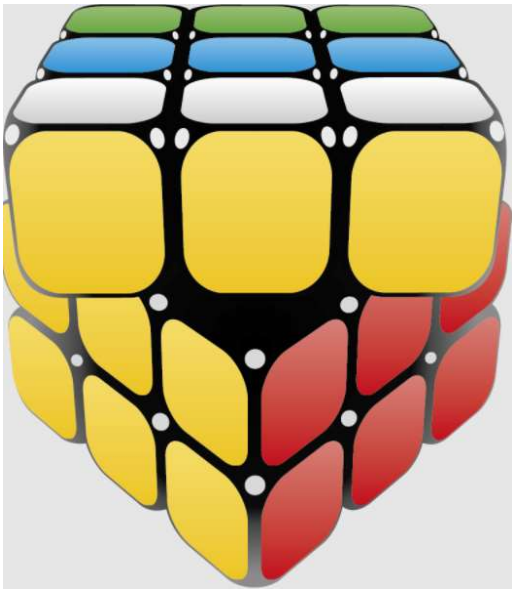
Rubik's Cube Final Project description :

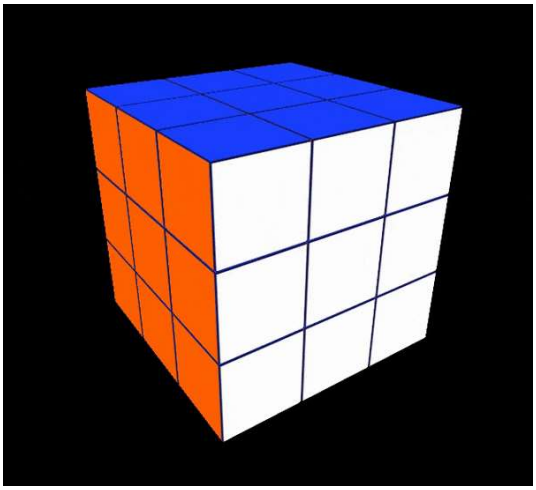
Ability to control the cube's rotations (moves). Plus shadows, lighting, environmental mapping, etc.





Project requirements (for 100% of the grade):

1. **You should be able to controllably (with some keys –** *see keys specifications below*) **rotate different planes of your cube with correct movements of all little cubelets. The rotations should be animated with some reasonable speed.**
2. **Your program should keep track of all "moves", and then, on a push of some key, reverse all the "moves" back to the original cube configuration. Those reversed moves should be animated too (one continuous animation).**

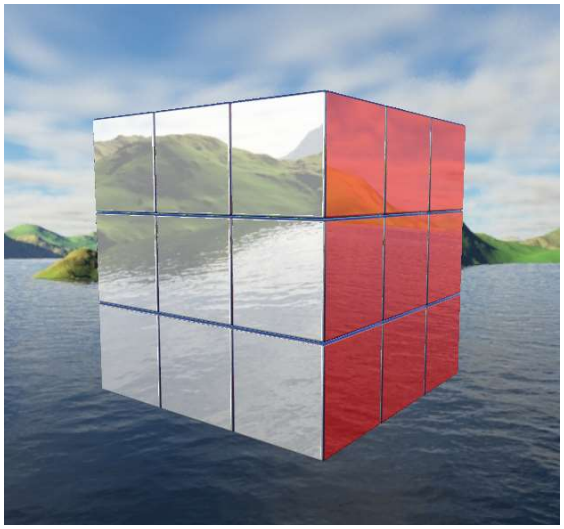


Grading comment:

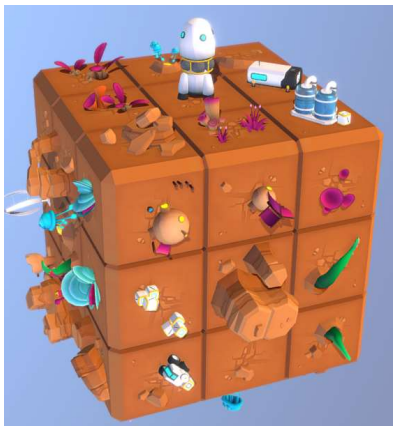
I will give you 95% if you finish just the first two steps.

If you don't finish these two steps, but finish all other steps: i.e., show the cube, change its orientation with arrows, have lightning, shadows, skyboxes, and so on (just missing cube's "moves") you can get 90% at most.

3. On a push of a key, your program should implement ADS lighting. Colors of sides should still be showing!
4. On a push of a key, you should have some "table" surface where we should see the shadows of the objects of your scene. (Use two pass shadow mapping). Colors of sides should still be showing!
5. For the previous two options (shadows and lighting) you should have an option of pushing a key to start moving your light source in some circle on top of the scene (that should have a noticeable effect on shadows or lighting).
6. On a push of a key, you should use environmental mapping – i.e. have some skybox and have it reflected in cubelets' metallic surfaces (but colors of sides should still be showing!). You can use skybox images from the example in the book.



7. Arrows should rotate your entire cube around, like we did in HW3.
8. Other buttons should rotate your camera around the object.
9. You don't have to use my `cube1.obj` file, you can create your own cubelets. Same for the skybox.



Some Hints (follow the link).

Keys to use:

(assume some default orientation first: **white** side is **Front** and **blue** side is **Up**, for example)

`L`	Left: rotate left side clockwise
`R`	Right: rotate right side clockwise
`D`	Down: rotate bottom 9 cubelets clockwise
`U`	Up: rotate top 9 cubelets clockwise
`B`	Back: rotate back 9 cubelets clockwise
`F`	Front: rotate front 9 cubelets clockwise
`Shift`	If Shift is pressed, then all the rotations above should be counterclockwise
`Arrows`	Rotate the object as before.
`Q`	Start reversing/rewinding the history, thus reassembling the cube
`E`	Toggles environmental mapping with reflecting surfaces
`S`	Toggles shadows (with light source, if it's off) and "table" under the cube, so we can see the shadow on it.
`A`	Toggles ADS lighting (with light source, if it's off)
`second S or second A`	Keys S and A should go through three stages: first one just turn on shadow (or lighting), second one: make the light source move in some circle on top of the scene, third one - back to default mode (no light).
`C`	Turns continuous rotation of a camera on and off

General requirements:

1. Your program should be using JOGL, JOML and GL4 OpenGL Context (don't use legacy OpenGL) and GLSL for shaders. Rule of thumb: your program should be using the same approaches that we used in our textbook's programs.
2. You can and should use our textbook's programs as starter/example code. But you cannot use any other code from the internet or from any other source. (In other words, don't use any code other than the code created by your group, provided by your instructor, or examples from our textbook!). Violation will result in filing a violation of academic integrity policy and a 0 grade!

What to submit:

1. Zipped folder of your project with all your files and a README.txt file that will have description of what your program can do and how. I should be able to simply run it using JGrasp (just by running your Code.java file).

   Due date is the end of Thursday of the finals week at the latest**! No late submissions will be accepted!**