Advanced shader

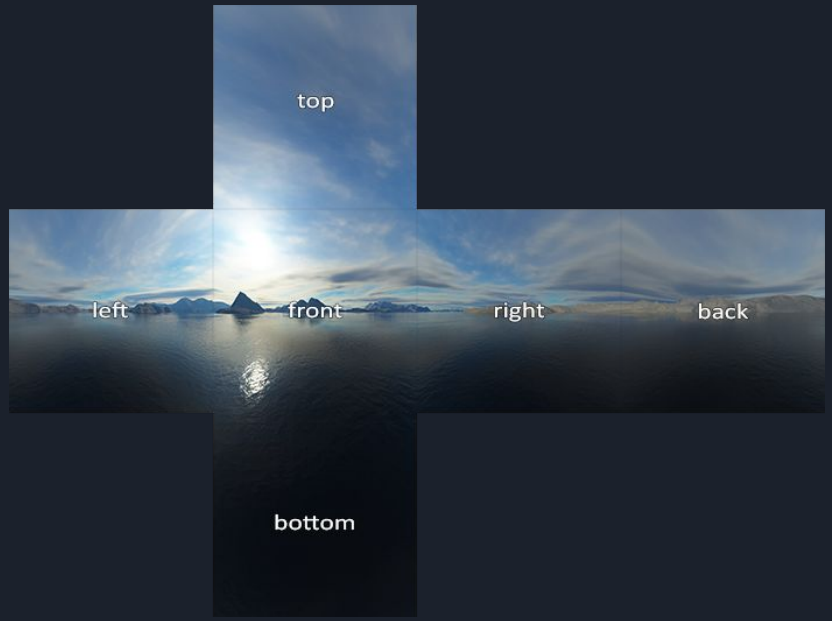
Homework 3 - 2022 Computer Graphics

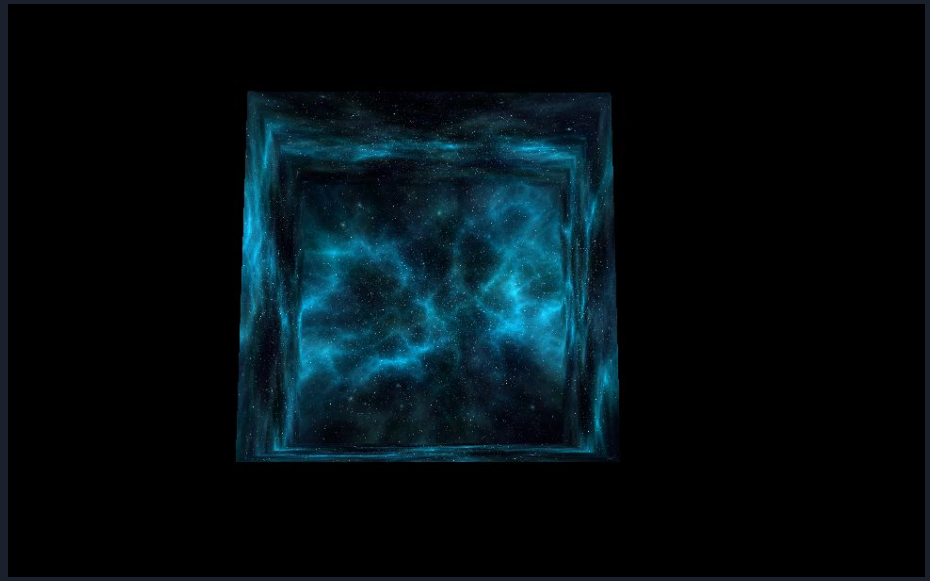
Advanced Shading

- In this assignment, you are going to write a program based on the provided template that implementes several shader effect with GLSL

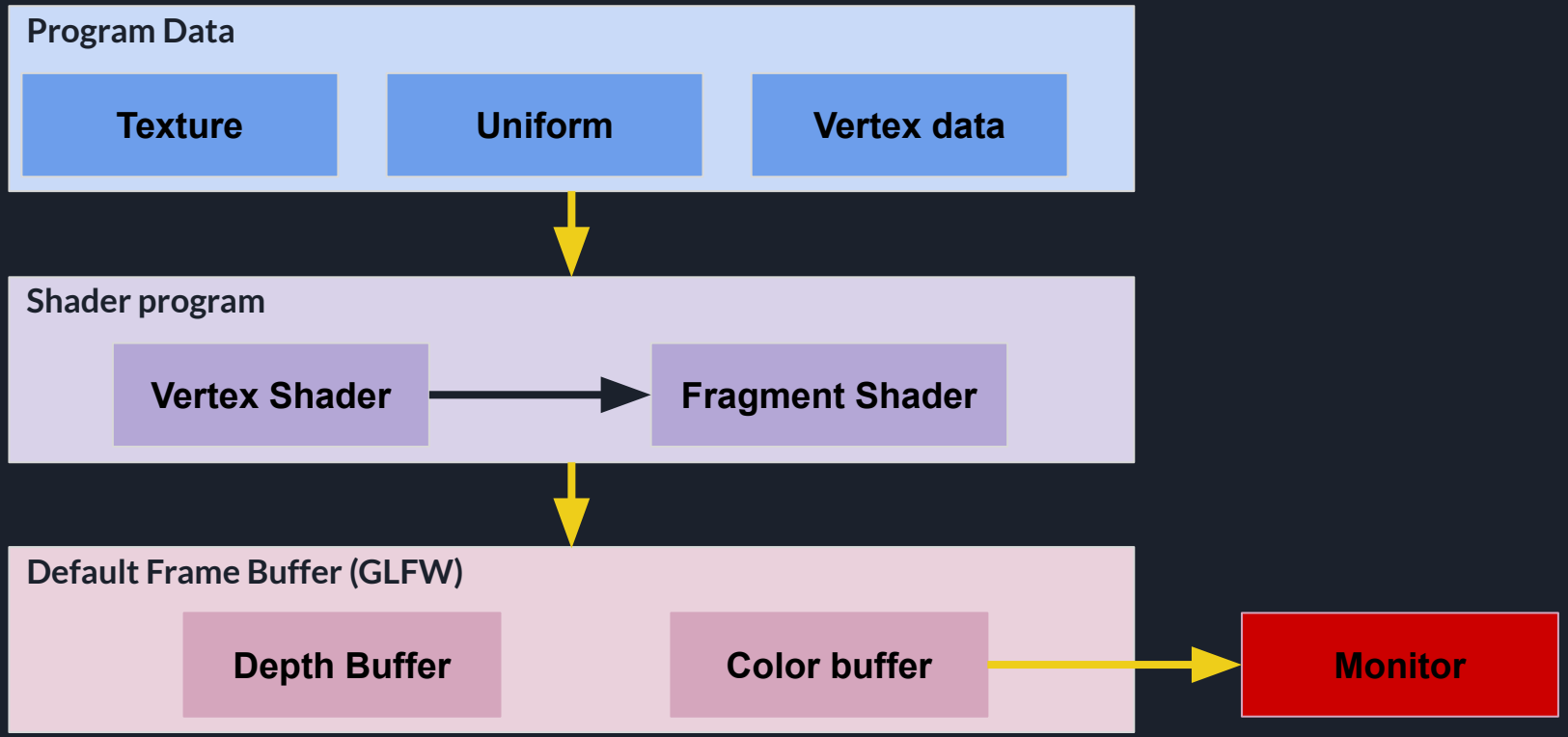
Skybox

- Fix camera position at center of the box

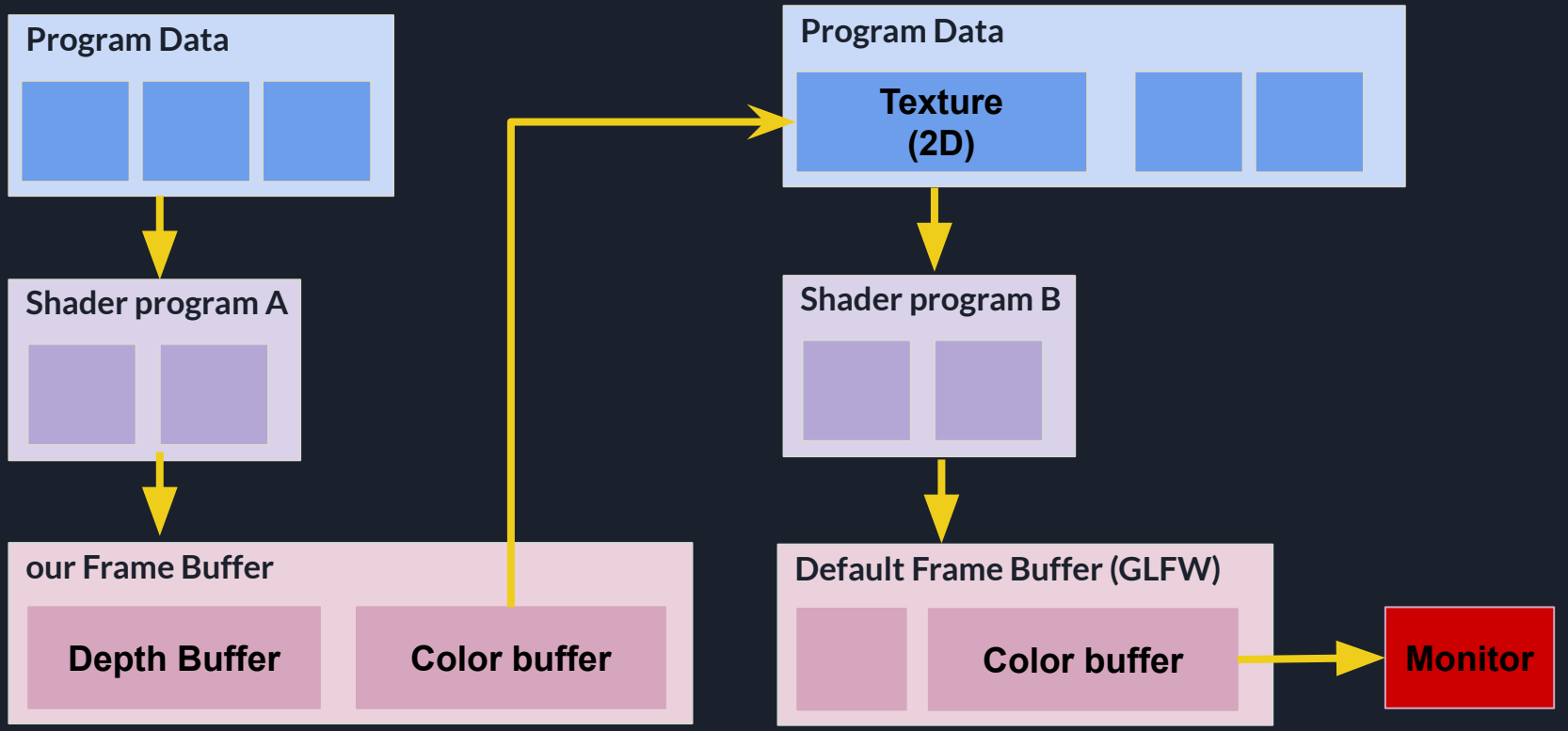




Framebuffer



Framebuffer as Texture

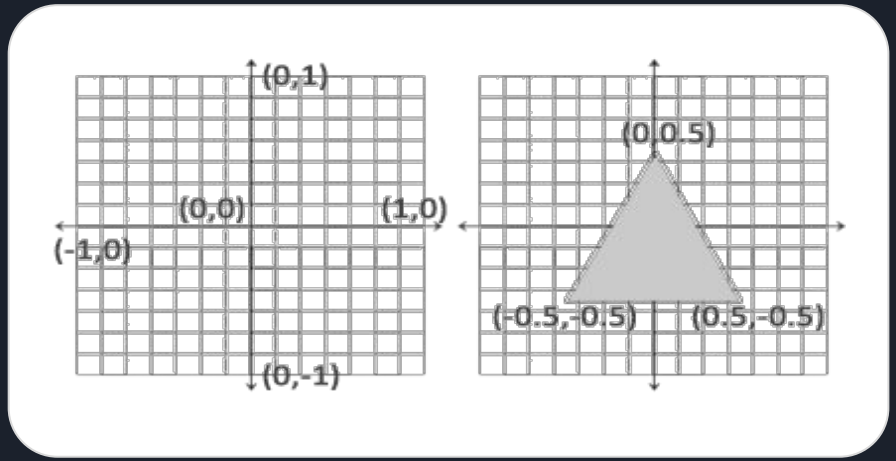


Advanced Shading

- Filters
  - Edge detection
  - Grayscale

Normalized Device Coordinates (NDC)

- A coordinate
  - before Screen-space coordinates
  - after Fragment shader
- Coordinate range x: [-1, 1], y: [-1, 1], z = 0 (no depth) fully map to sceen
- Draw vertex on NDC without any transform in shader program like directly draw on screen

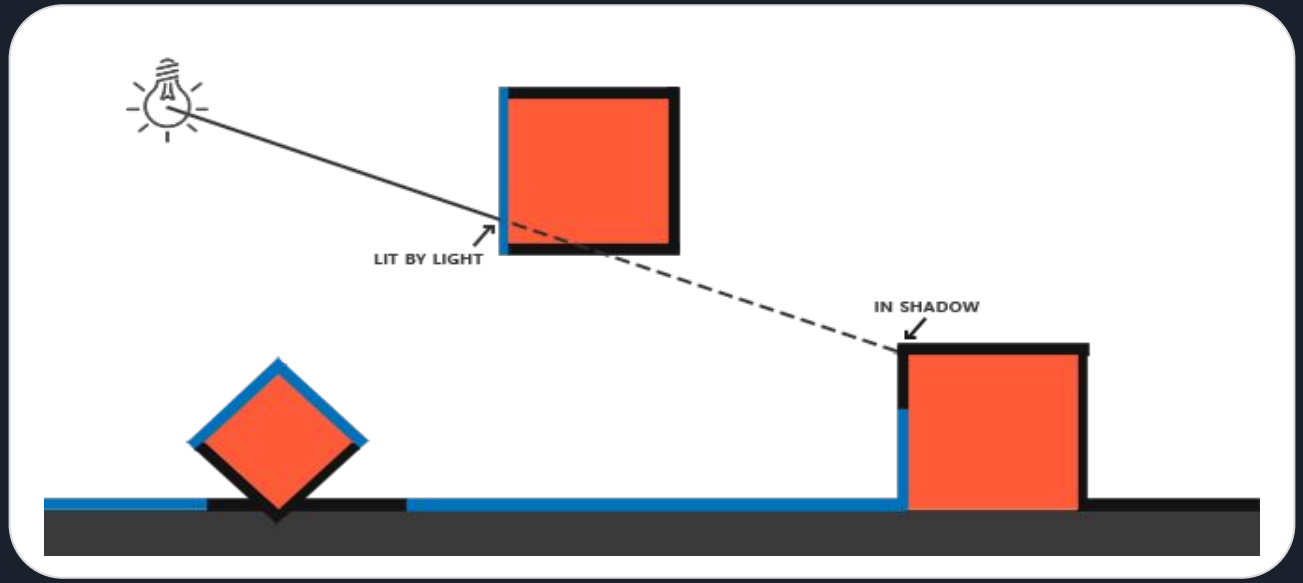


Advanced Shading

- Shadow
  - Shadow Mapping

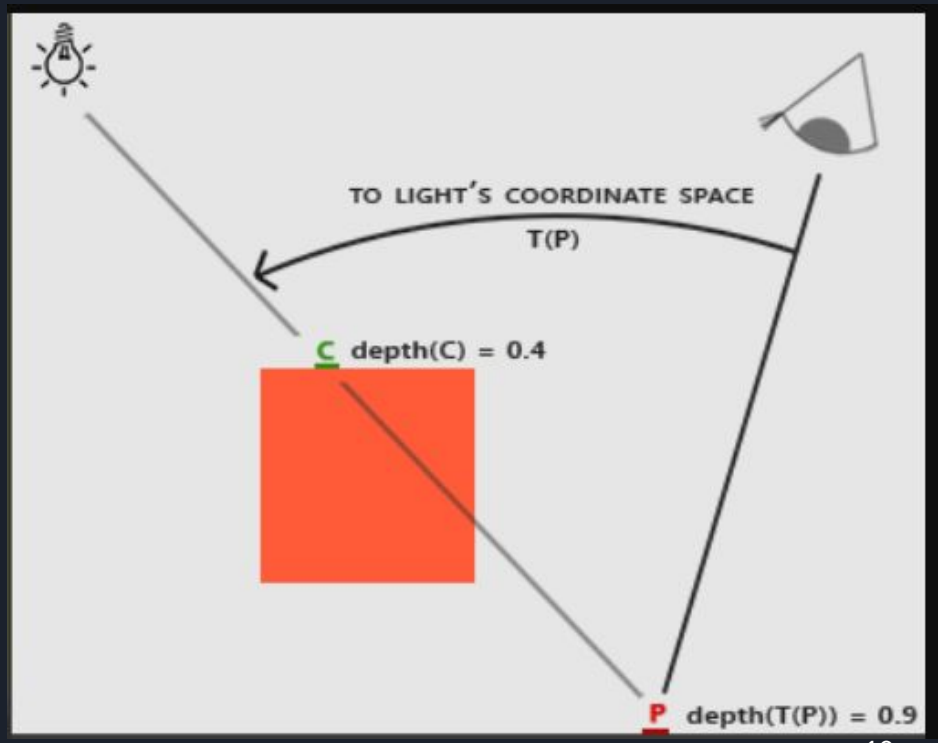
Shadow Map

- Render the scene from the light's point of view
  - Depth buffer store the closest fragment’s depth
  - Which means the fragment is ***not in shadow***
- Store depth buffer as a depth map

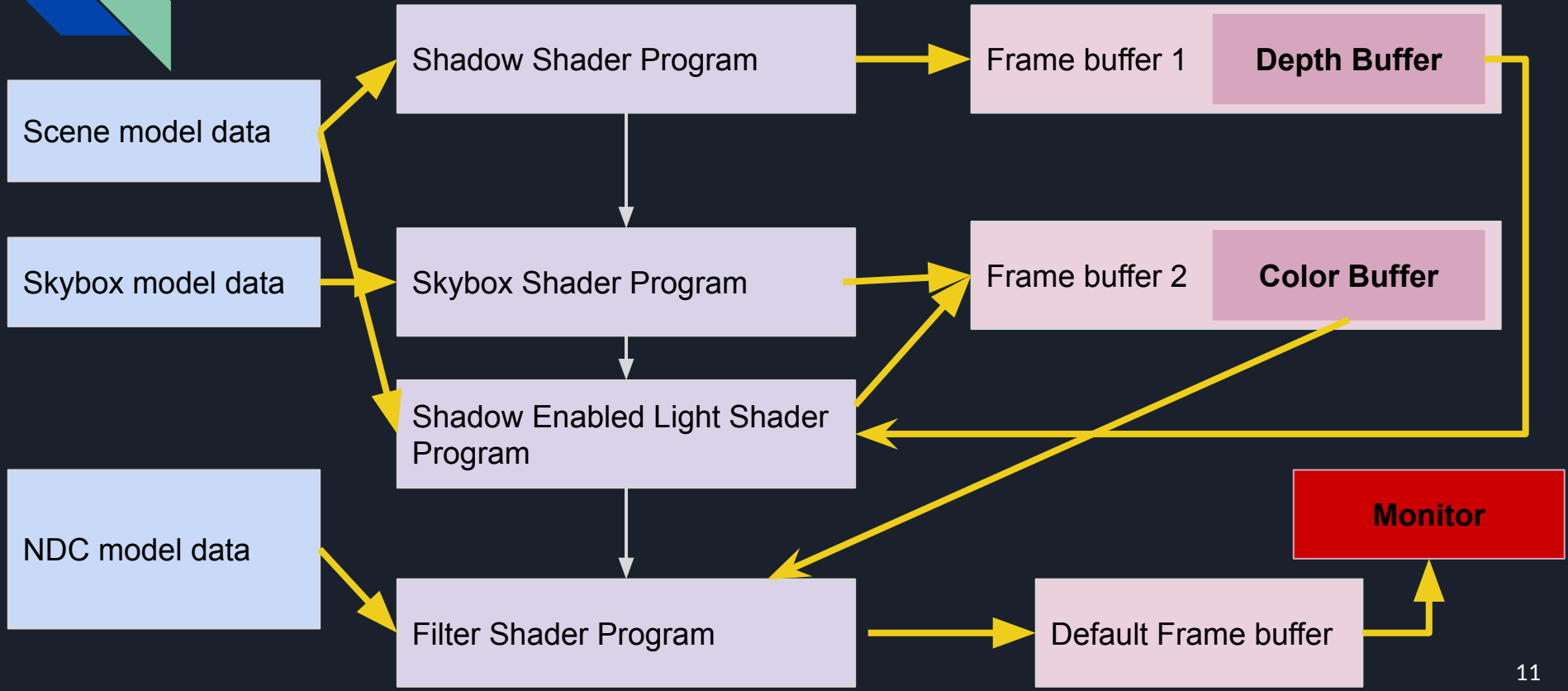


Shadow render

- When render the scene from camera's view
- Also check the depth of the fragment in light's view
  - If not equals to depth in depth map, the fragment is in shadow
  - Then set fragment's diffuse & specular color to zero.



Homework Flow



Control

- All control are implemented in templates
  - w/a/s/d, cursor: control camera position and rotation
  - k/l: change light direction
  - y: enable shadow
  - u: enable edge detection
  - i: enable grayscale

Spec

- Implementation (80%)
  - Task#0 Change window title to “HW3 - `student id`” (0%)
    - -10% if title is wrong,
  - Task#1 Skybox (20%)
    - Load skybox texture and generate object(5%)
    - Render skybox (15%)
  - Task#2 Shadow mapping (35%)
    - Generate shadow map (15%)
    - Enable shadow for one direct light (20%)
      - Solve shadow acne with static bias 0.002
      - Make shadow on further plane reasonable
  - Task#3 Filter (25%)
    - First fiilter (15%), second filter (10%)
      - Grayscale
      - Edge detection

Spec

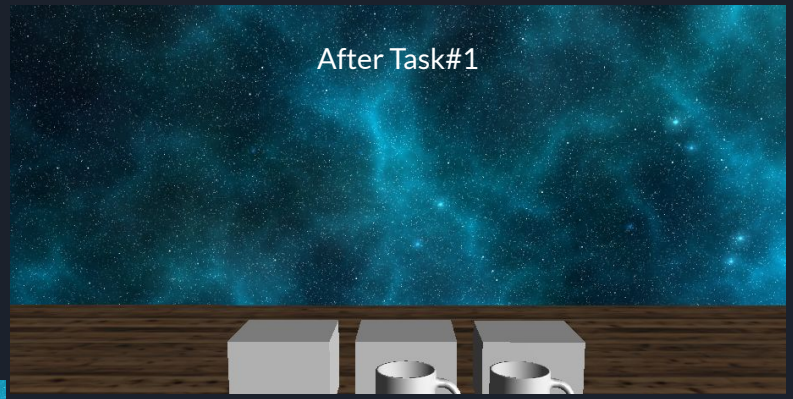
- Report(20%)
  - Implementation(HOW & WHY)
  - Problems you encountered
  - Don’t paste code without any explaination
  - No format restriction
  - File name: report_<your student ID> .pdf
- Bonus(10%)
  - Any creativity
  - Enable bonus by click any keys
  - Mention what you did in report

Hint

- You can read reference first
- Homework template is based on HW2 with refactor to satisfy HW3 requirements
- You can click ctrl+shift+F to search all TODOs in template
- Read the TODOs in the template and follow TODOs order
- Read notes to get more hints & ideas
- Before you ask question on E3, make sure you have Googled it
- Feel free to report bugs if you find one. :)

Before all

After Task#1



After Task#2 (no light direction change)

After Task#3

Notes

- Deadline: 12/5 23:59
  - You need to upload hw3_<your student ID>.zip and report_<your student ID> .pdf respectively
  - hw3_<your student ID>.zip (root)
    - src
    - include
    - assets/shaders
  - If you add or remove any files, you need to mention in report
  - You can use script/pack.ps1 (PowerShell) or script/pack.sh (Bash)
  - Incorrect submission will -5 points
- No plagiarism, -10 points per day after deadline
- No demo required this time
- No TA office hour
- Ask homework problem in E3 forum
- For personal problem, you please email to all three TAs from E3

Reference

https://learnopengl.com/Advanced-OpenGL/Cubemaps

https://learnopengl.com/Advanced-Lighting/Shadows/Shadow-Mapping

https://learnopengl.com/Advanced-OpenGL/Framebuffers