CSc 155 – Advanced Computer Graphics
Spring 2022 Scott Gordon

Assignment #4 – Advanced Techniques

Due Date: Friday, May 13th [4 weeks]

In this assignment, you will implement a 3D scene that incorporates several of the advanced effects that we learned in CSc-155. Your program must retain the following features from A1-A3: at least three objects, camera control, skybox, a positional or spot light that can be moved around, and at least one standard 2D texture. You are free to keep or change the implementation of any of the features from the way you did them before, as long as each capability is present.

- Try to design your graphical elements in a way that is logical and makes visual sense. Part of your grade will be based on your successful use of the chosen techniques.
- Try to design your graphical elements in a way that doesn't just copy the book's examples verbatim. That is, part of your grade will be based on your making a reasonable attempt to achieve an original use of the chosen techniques.

In addition, your program is to include the following new features:

- **Shadow-Mapping**
  At least THREE objects must be involved in shadow-mapping, either casting shadows, or having shadows cast on them.

- **Your SkyBox must not be one of the ones from the book**
  (some of you have already satisfied this requirement)

- **plus, FIVE of the following eight choices:**

  - **Tessellation shader** *in conjunction with a* **height map**
    or – **Cubic Bezier surface via Tessellation** *(with GL_FILL and color or texture)*
    or – **Some other non-trivial use of Tessellation**

  - **Geometry shader for primitive modification (**or **deletion,** or **addition)**

  - **Stereoscopy with red/cyan glasses, or splitscreen** *(e.g. Google Cardboard)*

  - **3D Texture** *or* **Perlin Noise use** *(for a use other than simulating water)*

  - **Fog** *and* **Blending/Transparency** *(to get credit for this one, need to do both - and for a use other than simulating water)*

  - **Normal/Bump Mapping** (procedural, or with a normal map image – *for a use other than simulating water*)

  - **Environment Mapping** *(such as for generating a mirror or chrome object, for a use other than simulating water)*

  - (counts as 2 items) **Simulated water with reflection/refraction and fresnel effect**

Additional Notes

- It isn't required that every feature you include be present simultaneously in your scene. You can instead use buttons or other controls to show the features, or alternate between them. However, that isn't required either – it usually is more interesting if they are all present at once.
- As with previous assignments, your program must be contained in a package whose name is "**`a4`**". Otherwise, requirements for compiling and running your program are the same as before.
- The same requirements as before with respect to submitted content continues to apply. Any textures, normal maps, models, height maps, etc. must have permission to use, and be correctly attributed to the source in your code and your report.
- The skybox images should be correctly oriented and without obvious seams. Lighting and shadows should not be applied to the skybox.
- Grading will be as follows:
  - 1.5 points for shadow-mapping
  - 0.5 points for the skybox
  - 5.0 points for the five remaining requirements (one point each)
  - 1.0 points for other existing requirements (skybox, models, camera control, lighting, etc.)
  - 1.0 points for the readme document
  - 1.0 points for submitting on time

Deliverables

- This is an INDIVIDUAL assignment.
- Submit to Canvas a ZIP folder containing:
  - All program, data, and batch files necessary to run your program, in the required hierarchy
  - a .PDF report file consisting of the following numbered items:
    1. a screenshot of your running program, showing as many features as possible
    2. a brief description of your scene
    3. a list of which objects participate in shadow-mapping
    4. a list of the five features you chose to implement, clearly describing how to recognize them.
    5. a list of user controls (such as for moving the camera or light(s))
    6. a list of which requirements you were NOT able to get fully working
    7. a list of any features you implemented that went beyond the assignment requirements
    8. a list of assets you used (i.e., models, textures, normal maps, height maps, etc.), with citation and permission/licensing information about those sources
    9. indicate on which RVR-5029 (remote) machine you tested your program