

CSC305 Assignment 3

Advanced Rendering Projects

Due 11:55pm, Monday, April 11th, 2016

In the final assignment of CSC 305, you can choose to extend and explore either of the two previous assignment projects. Ray Tracing and Raster Graphics (openGL) are the two most important methods of digital image synthesis. In practice the ray tracing methods are used for high-quality image synthesis that may take a long time to produce, for example animation films; while raster graphics are for real-time, interactive rendering applications, such as video games. Please pick one option that fits your interest.

You are not required to start a new programming project for assignment 3. Instead, please continue to work on your project of assignment 1 or 2 (part2).

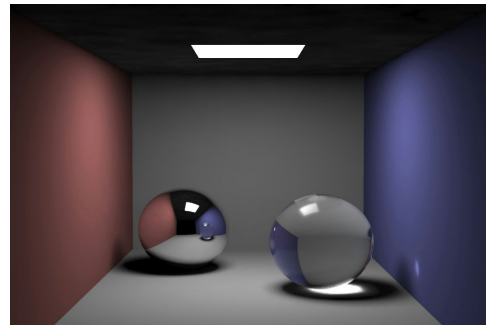
This is an open-ended project and you are welcome to work on any topics you wish to explore in computer graphics, and any substantial work will worth points towards the grade of this assignment. If you want to work on anything that is not on the following list, please talk to your instructor or TA !

Assignment 3A - Advanced Ray Tracer

If you choose the ray tracing option, first make sure that you can do everything required for assignment 1, including all Advanced Requirements.

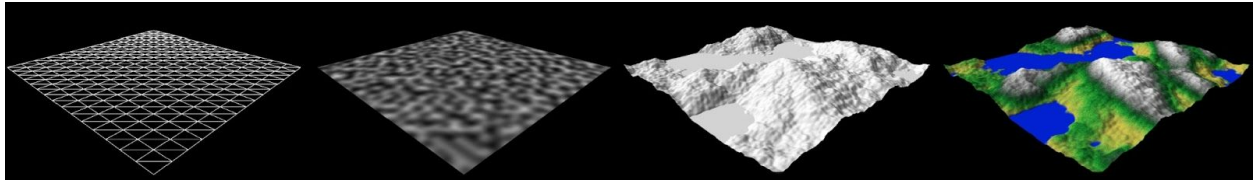
The requirements for assignment 3 are listed below:

1. Completely implement all features from Assignment 1, including all advanced requirements. (50%)
2. Create a cube room with a cube, a matt sphere, a reflective and a transparent refractive sphere in it. (10%)
3. Create an area light source with a relatively large surface area, and render soft shadow effect from the objects. (15%)
4. Using jittered anti-aliasing to enhance the quality of your rendered image. (5%)
5. Accelerate the ray tracer by using either: (10%)
 - a. Uniform space subdivision
 - b. Bounding spheres or hierarchical bounding spheres.
6. Benchmark your ray tracing program: How much time did your optimization save for your raytracing program? What is the relationship of the time saving and the complexity of your scene? Write a brief report (1~2 paragraphs) for your observation. (10%)



7. Feel free to propose your own features -- but talk to the instructor or the TA first!

Assignment 3B - Advanced OpenGL Rendering



Unlike ray tracing that focusses on the quality of rendered images, OpenGL and other raster graphics platforms (such as DirectX) excel at fast rendering and real time interaction. The requirements of this option place emphasis on interaction and view-controlling. Please take your code project for assignment 2 part 2 as a starting point for this option. Choose this project if you want to be a game programmer!

First, make sure you can implement every requirement in assignment 2 (if you cannot figure out the mouse-picking task that's okay). The additional requirements are listed below:

1. As a starting point, you should have several cubes with textures correctly rendered in your project, and the camera can freely rotate / dolly around the center of the scene. (30%)
2. Create a B-Spline camera path and move the **camera position** along the path inside your scene. Use keyboard to accelerate and slow down your camera on this path. (10%)
3. While the camera is moving along on the above path, use your mouse to look around in your virtual world by changing the **gaze direction**. Use the left button to change viewing angle and the right button to zoom in and out by changing the **orthogonal projection matrix** in your MVP chain. (10%)
4. Using procedural noise to generate a terrain mesh in addition to the cubes floating around. Create a planar grid mesh and use the noise value as height offsets to create mountains. Adjust the B-Spline camera track so the camera can fly on a reasonable track over the terrain, like a surveillance airplane.
 - a. Correct Noise Patch - 15%.
 - b. Noise Patch to Vertex Height - 10%
 - c. Correct Shading on the result terrain mesh - 15%
5. Use the keyboard to change lighting effects in the scene - for example, brighten or dim the lighting, change lighting color, and make the light sources moves around.
A good direction to go is to make day / night lighting effects. This could be implemented by a rotating light source around the terrain as shown in Lab 7, and changing the lighting colour along the way (white for the noon and golden for dawn/dusk). (10%)
6. Feel free to propose your own features -- but talk to the instructor or the TA first!