Assignment 2 - Term Project

CS174A Introduction to Computer Graphics

Winter 2019

Teams of 3-5 persons
Proposal due: Monday February 11, 2019, 11:55 PM
Code and Video due: Monday March 11, 2019, 11:55 PM
Report due: Friday March 15, 2019, 11:55 PM
Points: 100 possible points amounting to 15% of your grade
This assignment has a possibility for extra credit.
Start early; the time before each deadline will go by much faster than you expect.

You will design and implement a WebGL based programming project in teams of 3-5 persons.

Aside from a few technical requirements described below, you are free to choose whatever content you wish for your project, as long as it is safe-for-work (not NSFW). Examples of successful project types from the past include games, simulations, animations, and tools.

You will submit four pieces of content for this assignment. Before you begin implementation, you will submit a **proposal** of what your team is planning. After implementation, you will submit your **finished code**, a **video** demonstrating your code running, and a **report** summarizing your work.

After all projects have been submitted, you and your fellow students will vote to select the best projects in the class. The top projects will receive several percentage points of **extra credit**.

While all submitted work for this project is required to be your own (see the syllabus), you are allowed to include third party assets (e.g., geometric models, textures) as part of your project. However, you must clearly note the origin of each of these third party assets in your final report.

This project is quite open ended. The freedom to design your own project also presents a heavy burden of decision making, and it can be difficult to know where to start.

Here's some advice: Before you start any complicated implementation, find something that *you* find exciting, whether it be a story that makes you laugh or cry, a game mechanic that gets your blood flowing, a difficult task that could benefit from a novel tool, or a problem you find fascinating. Finding that core idea in advance will help to focus your design and implementation toward a stronger, more cohesive deliverable.

If you need help with ideas, please let us (the instructors) know and we can provide suggestions.

Rubric: There are 100 points possible, which correspond to 15% of your grade for the class. Note that the technical complexity and requirements components of the rubric comprise less than 70 points of your grade, so getting a high score will require creativity and a quality implementation.

- [60 points] Fulfillment of technical requirements as described in detail below.
- [4 points] Report and proposal quality. Details on both can be found below.
- [2 points] Video quality: Details on the video can be found below.
- [8 points] Technical complexity:
    - How difficult was the finished product to implement? Was it a significant feat of engineering, or just an integration of technology readily at hand?
- [9 points] Substance of material
    - Is the finished product interesting, entertaining, or meaningful outside of the context of a computer graphics exercise?
    - If it's a game, is the game fun? If it's an animation, is the story compelling? If it's a simulation, are the motion and rendering realistic? And so on . . .
- [9 points] Creativity
    - How creative are the ideas behind the project? Is it just a rehash of previous work, or is it a truly novel idea?
- [8 points] Overall Quality
    - Is the motion of the camera and objects smooth?
    - Is there an attention to detail in the scene geometry and materials?
    - Is the program free of noticeable glitches?

Technical Requirements [60 points possible]: Included with this assignment is a minimal code skeleton to give you a place to start; however, you are free to abandon the skeleton and start from scratch if you wish. Whatever you decide, all code modifications must be entirely your own. Below is a list of features that must be implemented in your final project to receive full points.

- [7 points] Show at least one three-level hierarchical object (e.g., a human finger).
- [6 points] Demonstrate the camera tracking a moving object using a *lookat* matrix.
- [7 points] Design at least one polygonal object of your own with custom positions, normals, UV coordinates, etc.
- [5 points] For one of your custom polygonal objects, show at least one flat shaded seam (a discontinuous edge).
- [6 points] Use a parametric curve or surface (spline) to model the motion or geometry of at least one of your objects.

- [6 points] Texture at least one of your custom polygonal objects procedurally or by mapping an image. This texturing must be UV mapped (e.g., not positionally or normally mapped).
- [23 points] Implement at least one advanced feature. If your team has more than three people you will be required to include an additional advanced feature for each additional team member. So, a team of four would need to implement two advanced features, and a team of five would need three. As part of your proposal, you will tentatively select advanced features, and we will provide feedback as to feasibility and relevance. While we encourage you to explore the wider computer graphics literature for advanced features most relevant to your project, possible advanced features include the following:
    - Collision detection (shape intersection tests) and response
    - Mouse picking: clicking to correctly select objects in image space
    - Procedural shapes: for example fractals (e.g., Sierpinski, Mandelbrot), implicit fields (marching cubes), subdivision surfaces, and plants (L-systems)
    - Procedural textures: for example Perlin noise and solid texturing
    - Shader particle effects: for example sparkles, fire, smoke, and splashing
    - Shadow mapping
    - Shader shape enhancement: bump or displacement mapping
    - Skeletal animation
    - Linear interpolation of rotations: quaternion slerp, exponential maps (geodesics), great circle interpolation
    - Spring/damper physics: algebra & neighborhood graphs

Proposal: Before beginning the implementation of your project, each team will submit a short (1-2 pages max) proposal document on or before February 8. You will receive feedback from the instructors on this proposal document shortly (hopefully no more than a few days) thereafter. We hope that this proposal step will not only help you plan your project, but also provide early feedback to help improve your ideas. The proposal document should contain the following information.

- **Team members:** Who is in your team? Please include UIDs.
- **High level description:** What are you planning to make? Why do you think your fellow students will find it interesting, meaningful, or entertaining?
- **Implementation:** What is it about your project that will be impressive from a computer graphics perspective? How do you plan to fulfill the technical requirements? What advanced features are you planning to implement, and why have you chosen them?
- **Division of work:** In your team, who will do what?
- **Challenges:** What do you anticipate to be the most difficult parts of your project? If you find you run out of time to finish your project, how do you think things may change?

Project Report: Along with your final code, you will submit a concise report describing your finished project. This report should contain the following information.

- **Team members:** Who is in your team? Please clearly note if the members of your team have changed since your proposal was approved, and include all member UIDs.
- **High level description:** What have you made? Why do you find it interesting, meaningful, or entertaining? If it is interactive, how is it designed to be used?
- **Implementation:** What parts of your project fulfill which parts of the technical requirements? Why is your work impressive from a computer graphics perspective?
- **Division of work:** In your team, who did what?
- **Adherence to plan:** What was the most difficult part of your project? Was it what you expected at the planning stage? What did you find you had to change from your plan?
- **References:** What sources (e.g., books, tutorials, blogs) did you consult in the development of your project? Are any of your assets (e.g., geometric models, textures) from third party sources? If so, which assets, and where did they come from?

Video: Record and submit a video of your program running for 90 seconds or less. This video should serve as a demonstration of your project, and will be presented during the showcase at the end of the quarter as a representation of your work for the purposes of class voting.
You may add subtitles to provide context, but otherwise you cannot edit your recording in any way. Make sure you encode your movie to a maximum of 100MB.