

CS 184: Assignment 5 — Final Project

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Goals and Logistics

The final project is a chance to showcase what you’ve learned in the course, to develop a project of your choice. This should be done in groups of two, but we will allow you to work individually if you want. We fully understand that you have only two weeks for this, that also needs to be used in studying for finals. As such, we will have fairly modest expectations of what can be achieved.

The main goal of this assignment is that you should extend one of the homework assignments (of your choice) to add new functionality, and make the assignment really nice. (This would roughly be the extra credit part; if you already got extra credit though, you need to do more or pick a different assignment). We also give ideas for an animation project, and are open to other possibilities (that is, you can propose a project of your choice; simply ask the instructor and TA).

I again want to emphasize that since time is short and you have numerous other issues to deal with, don’t go overboard unless you really have the time. A very simple project that addresses some of the extra credit portions of the previous assignment is more than adequate. I view this as an easy way to make one really nice assignment in the course, and get some points, rather than as a terrible last-minute struggle. You should certainly not aim on spending as much time on this as in homeworks 3 or 4. Obviously, given the timeframe, we expect that you are familiar with the base assignments, and therefore there is little support (no skeleton code). You may of course reuse any material you wrote from earlier in the course.

Since this is a relatively open assignment, your submission (“submit as5”) should just include a *README* that links to a website and has any other pressing information of interest (also make sure it includes the name of your partner or if you worked alone). Submission of source/executable code is optional. Do not modify the website after the due date. Since this assignment is more open, grading will be based on a qualitative sense of what you accomplished. Therefore, the website and writeup is really crucial, as we will not have time for demo sessions. Hence, make sure it fully documents what you did, and includes example images (and video if relevant).

Your submission must be on time, since grades need to be submitted soon. As such, a stronger late policy applies than the default for the course, and the instructor reserves the right to not count (or very heavily penalize) late submissions. Plan ahead and turn in what you have.

Project Ideas

Here are some project ideas (note that you only need to do one, only need to add one or two features, and we strongly recommend you build on one of the earlier assignments, effectively doing the extra credit portion of that). These ideas are much less specified than in earlier homeworks. This is because the project is open-ended, and you should feel free to exercise your creativity (just make sure to document what you actually did when you turn in your submission). You are also free to propose a comparable separate or related project of your interest; does not have to be the suggestions on the next page. At the same time, please bear in mind again that you need/should not go overboard, and doing one or two extra credit features of an existing assignment is adequate. Balance your time with preparation for finals wisely.

- *Transformations:* Extend assignment 1 to also support other transformations, such as translations and scales. Then, consider developing a simple program that allows taking a few simple objects (teapot, sphere, cube) and interactively placing them in the world with appropriate transformations (translations, rotations and scales). Try to use this to make a nice scene like 3 objects on a table.
- *Curves:* If you have not already done the extra credit, an obvious extension of homework 2 is to the extra credit part, to take a curve and generate a surface of revolution. An alternative project is to extend the B-Spline curve editor to go from uniform to non-uniform, possibly rational NURBS. There are many other possibilities, such as drawing a variety of surfaces beyond just those of revolution. The idea is to make a more complete modeling package (note that only one of these extensions is required; you do not need to do all).
- *Interactive Rendering:* The OpenGL assignment in homework 3 can easily be extended with many of the extra credit items listed. One possibility is to learn about programmable shaders, and make at least a variety of basic effects using them. For the really ambitious students (i.e. almost nobody), you could try extending the homework into a video game with interactive gameplay. Given the timeframe, it would probably need to be a relatively simple game.
- *Raytracing:* There are numerous extension possibilities for raytracing, such as those listed in extra credit. Try to do at least one of optimized acceleration structures, more primitives (cubes, cones, spline surfaces would be nice but not essential), distributed ray tracing for area lights and soft shadows, motion blur or depth of field. The really ambitious among you might also try to write a global illumination renderer, at least for diffuse surfaces, by bouncing photons.
- *Animation:* Unlike the previous topics, there is no base animation assignment to extend, and you need to start from scratch. As such, I would recommend this only if you feel like you have a lot of time available, have already done exceptionally well in the course, you work in groups of two, and you really have strong interest in animation.

The goal is to build a basic inverse kinematics system. You may want to start with the analytic formulae for a two-joint arm, but you would ideally like to have a general solver for at least four joints (and preferably with different lengths). The root should be stationary (attached to an immobile base). There should be some interactive or offline mechanism to specify the goal point in 3D (or create a procedural animation), and the IK solver should select joint angles to reach the desired goal. For submission, make a video that clearly shows your system working (and any problems if relevant), where the goal path is something complicated, that tests the full range of motion (a circle or large arc or figure-eight, not just a line). It would also be nice if you gracefully handled configurations that cannot be achieved (are out of reach). Make sure to try to cover the full range of the arm's operating space in terms of joint angles. Clearly, a full video documenting everything that was done is crucial. Note that the rendering can be very simple, reusing homework 3 or any other relevant code; we want to focus on the animation.