Thesis Course Syllabus

Course Information

Course Prefix and Number: CS 8803 PCG
Course Name: Procedural Content Generation

Instructor: Greg Turk (he/him)
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Course Description

Procedural Content Generation (PCG) refers to the creation of content (geometric models, images) by writing computer code (procedures). There are a wide variety of geometric models that can be created using procedural methods, many of which will be covered in the course, with the inclusion of topics such as terrain, plants, animals, streets, dungeons, buildings, and vehicles. The most common applications of PCG are for video games, feature film special effects, virtual reality and computer-generated art. Some video games that make use of PCG include Minecraft, Spore, and No Man's Sky. This course will cover a broad diversity of algorithms that are used to create geometric models and images.

The emphasis in this course is on creating geometric forms using "classical" techniques in graphics, and not using AI-based techniques. There are likely to be one or two lectures on AI methods for content generation near the end of the semester, but this is not a major focus of the course.

This course will cover many of the methods used in content generation from academic research. Course topics include: creature anatomy, terrain, street layouts, buildings, dungeons, mazes, plants, textures, Bezier surfaces, implicit surfaces, pseudo-random numbers, modifying numerical distributions (e.g. bias and gain) and band-limited noise.

Course Learning Outcomes

By enrolling in this course, students will:

1. Learn about various 2D and 3D shape descriptions, including lines, polynomial curves, polygon meshes, Bezier patches, subdivision surfaces and implicit surfaces.

2. Study algorithms that can be used to create both natural and human-made structures such as plants, terrain, streets, dungeons and buildings.

3. Write programs within the Unity game engine (using C#) that implements a number of the algorithms covered.

Required Course Materials

There will be no required textbook for the class. Most of the materials for PCG algorithms will draw upon published work from the video game, computer graphics and computer vision communities. The relevant articles will be provided on Canvas.

Grading Policy

Students will receive a letter grade based on standard 10-point percentage ranges:
A ≥ 90% B ≥ 80% C ≥ 70% D ≥ 60% F below 60%

- Warm-up projects (two): 6%
- Large programming projects (four): 80%
- Midterm: 7%
- Final Exam: 7%

Note that the both the midterm and the final exam will be 50 minutes long. The final exam will take place on the same day and time as is given for this course's time-slot in the Final Exam Matrix for Fall 2026.

The grading breakdown (shown above) will be the same for undergraduates and graduate students. However, the requirements for the large projects will be more difficult for graduate students.

Programming Projects

Content creation methods are best learned by writing code. Each student will complete four large programming projects, all of which will be written in C# scripts in the Unity game development environment. There will be two small warm-up projects in addition to the larger projects. You will carry out all of the projects individually. 15-20% of your grade for each large project will have an "effort" component, which is our evaluation of how much care, thought and creativity you put into the project. 80-85% of each large project's grade will be whether you demonstrate each of the required elements in your project. Note that it is impossible to get a good grade in this course without completing all of the large programming assignments.

We will use the Unity game engine for all of the course projects. You can install a student version of Unity on Windows, Mac and Linux computers.

Late Policy

The grade on a late assignment will drop 5% for each day beyond the due date. A day ends at 11:59 pm. Assignments turned in up to three days late will be accepted (with penalty). No assignments will be accepted more than three days late. For example, if a project is due on October 10, you can turn in the assignment up to October 13 (with a 15% late penalty), but an assignment turned in on October 14 or later will not be accepted.

Attendance Policy

All class sessions will be in-person in our classroom. There will be no remote course delivery options for the class, and lectures will not be recorded.

There will be no formal checks of attendance for regular lecture class sessions. That being said, it is unwise to miss class sessions since it will be difficult to do well in the course without learning the lecture materials.

Academic and Research Honesty/Integrity Statement

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Students are expected to perform research in an ethical and responsible manner. All Doctoral and Master's Thesis students are required to take the Responsible Conduct of Research training, and it is expected that students abide by the principles taught in that training while performing research.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct.

Core IMPACTS

Not applicable.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to make an appointment to discuss your

special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Expectations of Advisors and Advisees

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulates some basic expectations that you can have of me and that I have of you. Additional information for research-related work is given in The Expectations of Advisors and Advisees. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.