CIS 585 – Game Engine Design  
Spring 2015

Instructor: Nathan Bean  
Email: nhbean@ksu.edu  
Class Time & Location: Tuesday & Thursday 3:55pm – 5:10pm, Nichols 122  
Office Hours & Location: Friday 3:30pm – 5:00pm, Nichols 216  
Final Exam Period: 2:30pm – 3:50pm Tuesday, May 12

Course Description
Current practices of game engine development. The game engine as a soft real-time multi-agent simulation. Three-dimensional graphics and animation techniques, scene management, physics simulation, event systems, resource management, and network game architectures. Design and prototyping of a general use game.

Prerequisite
CIS 580 and Math 551

Course Resources
Course Texts:
  - Game Engine Architecture, 2nd Edition, Jason Gregory
  - 3D Math for Game Development (recommended)

Online Resources
  - MSDN DirectX Documentation  

Additional course resources will be made available on the K-State Online course page.

Course Software
We will be using a combination of technologies, including DirectX, Visual Studio 2013 (Ultimate), and C++. Visual Studio is available through your Dreamspark accounts. The DirectX SDK is now integrated into the standard windows libraries, and no longer requires a separate download.

For 3D models, we will be using the Collida 3D model format, and likely working with Google Sketchup, which is available here: [http://www.sketchup.com/download](http://www.sketchup.com/download).

In addition, we will be using Git to manage our project code. Git now integrates directly into Visual Studio 2013. See here for details: [http://msdn.microsoft.com/en-us/library/hh850437.aspx](http://msdn.microsoft.com/en-us/library/hh850437.aspx). Course code will be hosted in a public GitHub repository – students should also create and provide their github account names.

Additional software may be added to this list as the semester progresses.

Course Goals
Game engines are among the most complex software systems found in modern computing practice, and draw from nearly every sub-discipline in the field. Building a game engine is a daunting task, and one not to be undertakin lightly. Notnetheless, few projects will help you develop your skills and hone your
understanding of software systems as a game engine can. For this semester, my goals for you as students are:

1. To develop a broad understanding of the common systems found within a game engine
2. To understand how game engines fit into the discipline of computing science, and forge connections between the subjects of your prior and future coursework
3. To gain practical, industry-like experience in team-driven software projects of substantial complexity
4. To develop a prototype engine that will be a valuable addition to your software portfolio, and perhaps serve as a foundation for future work.

All of our activity in this course semester will be informed by these goals. Course assessments (grades) will also be driven by these goals.

**Topics List**
Each semester the topics vary somewhat depending on the needs of the game engine being developed and the interests of the students. The following topic list indicates the general thrust of where the course will go – but the list may well change during the semester. Also, if you have particular topics you wish to see covered that are not present in this list, please let me know and I will do my best to incorporate them.

- Rendering pipeline and hardware
- 3D models
- Shaders and lighting
- Game engine architecture
- Memory management
- Resource management
- Scene graphs
- Animation (hierarchical, skeletal, and vertex)
- Particle systems
- Decal systems
- GUI design
- Input handling
- Physics engines

**Course Structure**
In the interests of course goals #3 and #4, we will be adopting several of the development practices of Scrum methodology to guide the development of our assignments – specifically the use of sprints. Every 2-4 weeks of the course will consist of a sprint, where we will work on creating and integrating new systems and game content into our prototype game, engine, and tools. At the beginning of each sprint, we will, as a class, discuss, plan, and establish our sprint goals. At the conclusion of each sprint, we will hold team code reviews and assess how well the sprint goals were achieved. 50% of your final grade will be based on your efforts during the sprints.

**Development Blogs**
In lieu of mid-term examinations, and in pursuit of course goal #2, each student will be responsible for blogging about their development efforts on a blogging platform of their choice, with urls to specific entries turned in via K-State online. Your blog should discuss each major contribution you
have made to the code base, the challenges you have encountered and how you have overcome them, and highlight how you see your efforts interact with the domains of computing science, as well as with the course readings. Discussing connections between your efforts and other coursework is strongly encouraged. Students should also follow and comment on their fellows’ blogs, through peer review assignments on K-State Online. 10% of your final score will be derived from your blog. A rubric outlining how blogs will be assessed can be found on K-State Online

**Documentation Wiki**

In the support of course goals #1, #3, and #4, we will also be creating a wiki on our Github page to document the game engine’s systems as it is built. Clearly, this wiki will evolve over time as the engine takes shape, but our goal will be to use it to provide clear, consistent documentation on the structure and function of the game engine and its systems. Every student should document the systems that they are involved in developing, focusing on 1) explaining how the system works, and 2) how other programmers should interact with the system in question. Your contributions to the wiki will determine 10% of your final grade.

**Open House**

We will aim to have a playable prototype ready to demonstrate at Open House on April 20th. We will treat this event as though it were an industry expo where we are unveiling our new game. The class will also be responsible for promoting the demo, seeing that the game is installed on demonstration machines, and be on hand to speak with Open House audiences. The Open House demonstration (including participation) will consist of 10% of your final grade.

**Final Project and Presentation**

In lieu of a final exam, the class will develop a polished demonstration game using the engine developed over the course of the semester. During the final exam period (2:30 May 12) the class will demonstrate this game, discuss the choices made in developing the engine, and highlight the challenges they faced and how they were overcome.

**Grading Breakdown**

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<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tr>
<td>Sprint Reviews</td>
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<tr>
<td>Documentation Wiki</td>
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<tr>
<td>Development Blogs</td>
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<tr>
<td>Open House Presentation</td>
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<td>Final Game</td>
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<td>Final Game Presentation</td>
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**Attendance Policy**

For effective team interactions, it is vital that you attend and participate in each and every class. More than three unexcused absences will result in a 25% reduction in their final grade for the course. Students with five or more unexcused absences will automatically fail the course. Students who have an excused absence should still make every effort to coordinate with their fellow students to ensure our development process is unhindered.

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**Academic Honesty**

Kansas State University has an Honor System based on personal integrity, which is presumed to be sufficient assurance that, in academic matters, one's work is performed honestly and without unauthorized assistance. Undergraduate and graduate students, by registration, acknowledge the jurisdiction of the Honor System. The policies and procedures of the Honor System apply to all full and part-time students enrolled in undergraduate and graduate courses on-campus, off-campus, and via distance learning. The honor system website can be reached via the following URL: [www.ksu.edu/honor](http://www.ksu.edu/honor).

A component vital to the Honor System is the inclusion of the Honor Pledge which applies to all assignments, examinations, or other course work undertaken by students. The Honor Pledge is implied, whether or not it is stated: "On my honor, as a student, I have neither given nor received unauthorized aid on this academic work." A grade of XF can result from a breach of academic honesty. The F indicates failure in the course; the X indicates the reason is an Honor Pledge violation.

Games face a number of challenges most other assignments don’t – they incorporate multimedia assets, code assets, and many other elements. Because these become a part of the game, the game itself becomes a derivative work – so citing your source material is no longer sufficient. Please be aware of copyright law, and that including copyrighted works that you do not have a license or other permission to use within your game is both illegal and will be viewed as academic dishonesty. Licenses to any material you use should be included in a “license” folder within the project itself, and licensed material needs to be clearly identified.

**Students with Disabilities**

"Any student with a disability who needs a classroom accommodation, access to technology or other academic assistance in this course should contact Disability Support Services ([dss@k-state.edu](mailto:dss@k-state.edu)) and/or the instructor. DSS serves students with a wide range of disabilities including, but not limited to, physical disabilities, sensory impairments, learning disabilities, attention deficit disorder, depression, and anxiety."

**Expectations for Classroom Conduct**

All student activities in the University, including this course, are governed by the Student Judicial Conduct Code as outlined in the Student Government Association By Laws, Article VI, Section 3, number 2. Students that engage in behavior that disrupts the learning environment may be asked to leave the class.

**Campus Safety**

Kansas State University is committed to providing a safe teaching and learning environment for student and faculty members. In order to enhance your safety in the unlikely case of a campus emergency make sure that you know where and how to quickly exit your classroom and how to follow any emergency directives. To view additional campus emergency information go to the University's main page, [www.k-state.edu](http://www.k-state.edu), and click on the Emergency Information button.