CS 405 Computer Graphics

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Course Content
This course is an introduction to computer graphics, modeling, animation, and rendering. Topics covered include basic image processing, geometric transformations, geometric modeling of curves and surfaces, animation, 3-D viewing, visibility algorithms, radiosity, ray tracing, shading, and volume rendering. Students gain experience by developing their own graphics programs producing simple animations.

In the second part of the course, we will cover data visualization basics and how to create interactive visual analytics tools.

Objectives
The objective of this course is to understand the workings of computer-generated images, animations, and visualizations. The students will master the basics of computer graphics in theory and practice. At the final project of this course is design and development of a computer game from scratch.

Recommended or required reading
Reading material will be distributed.

Course Outline
This is the first course on computer graphics, introducing the basics of 2D and 3D graphics. There will be tutorials on Linear Algebra, Signal Processing, Software Engineering, and Advanced Graphics Topics. There will special emphasis on data visualization and 3D interactive software development.

Course Policies
Plagiarism: There is no teamwork encouraged in this course. You are expected to research and develop course projects alone. You can use some allowed resources but before using them you must contact the course instructor or assistants to make sure that you are not crossing the line. This is very important.

Plagiarism and academic integrity are very important issues. You only have your reputation in the academic world. And it takes only one mistake and it is forever lost. As long as you are a student the rule is simple: be honest
and open to your Professor/Adviser. Explain him all the sources you used and how you used. If you are doing something you will get embarrassed explaining to me, you are doing something wrong. *Any plagiarism will lead to grade F without any exceptions.*

Project: There will be two projects:

3D Projects. Implemented on OpenGL with C++. The project requirements will be distributed separately.

Data Visualization Project. Implemented with Python and/or Javascript. The project requirements will be distributed separately.

Assignments: Every other week there will be a graded written or coding assignment.

Grading

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ray Tracing</td>
<td>15%</td>
</tr>
<tr>
<td>3D Projects</td>
<td>40%–55%</td>
</tr>
<tr>
<td>Visualization Project</td>
<td>15%</td>
</tr>
<tr>
<td>Assignments</td>
<td>30%</td>
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</tbody>
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We will take the best two of all 3 Assignments into consideration. The weight of each Assignment will be 10%, 30% in total.

We will take the better one of the Ray Tracing and Visualization Project and contribute to 15% of the total grade.

The 3D project will have two parts instead of three and each part will have equal weight. In total the 3D project will have 55% of the total grade instead of 40%

Participation is expected and *highly rewarded*…
**We will announce deadlines for each project separately.**

<table>
<thead>
<tr>
<th>Week</th>
<th>Course</th>
<th>Assignment</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction / Linear Algebra</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>Representation, Camera Projections</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>Shading, Illumination</td>
<td><strong>Assignment</strong> Linear Algebra, Representations</td>
</tr>
<tr>
<td>4</td>
<td>Ray Tracing</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>Transforms</td>
<td><strong>Assignment</strong> Camera, Shading &amp; Illumination</td>
</tr>
<tr>
<td>6</td>
<td>Models, Mesh</td>
<td>None</td>
</tr>
<tr>
<td>7</td>
<td>Models</td>
<td><strong>Assignment</strong> Transformations, Models</td>
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**Project** Ray Tracing

**Project** 3D Project 1
Week/Date     8 /  
Course        Animations  
Assignment    None

**Project**   **3D Project I**

Week/Date     9 /  
Course        Curves  
Assignment    Mesh, Animations

Week/Date     10 /  
Course        Textures  
**Assignment**   **all topics until week 10**

Week/Date     11 /  
Course        Textures  
Assignment    Textures

**Project**   **3D Project II**

Week/Date     12 /  
Course        Data Visualization  
Assignment    None

Week/Date     13 /  
Course        Data Visualization  
Assignment    None

Week/Date     14 /  
Course        Data Visualization

**Project**   **Data Visualization**