This class involves simulating characters in vehicles for games. You won't learn much if you cheat but you might get a good grade if you get away with it. If all assignments are handled retroactively, even after the semester in which the course was taken for credit. This is a challenging class aimed at teaching the fundamentals of computer graphics. You need to login to the UofT vpn to access these additional graphics resources (papers/presentations).

**Required Textbook**

Lectures

Lectures are available at 


The student is expected to read background material on the hardware and local software, and should be comfortable with elementary linear algebra, curvature, convolution, matrix algebra, and computer vision. The student should have a strong background in computer science with multivariable calculus, linear algebra, computer graphics, numerical methods, computer vision, and computer science.

*Additional Graphics Resources (papers/presentations)*

- OpenGL Tutorials at http://www.opengl-tutorial.org
- www.cplusplus.com
- The Matrix Cookbook
- OpenGL/Triangle Cookbook
- CRC Press

**Course Overview**

This course introduces the basic concepts and algorithms of computer graphics, which encompasses computer models of real-world objects and their behavior. Students learn the mathematical foundations needed to simulate natural phenomena, such as lighting, shading, reflection, refraction, and transparency. The course covers topics such as geometry, shading, lighting, rendering, graphics hardware, ray tracing, graphics toolkits, animation systems, and viewports, clipping, visibility, illumination and reflectance models, radiometry, energy transfer models, parametric representations, and more.

**Required preparation:**

- C/C++ Programming
- Linear Algebra
- Calculus
- Numerical Methods
- Multivariable Calculus

**Lecture Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture Topic</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>06/10</td>
<td>Introduction</td>
<td>Assignment 1 (Raster Images) due 20/09</td>
</tr>
<tr>
<td>2</td>
<td>13/10</td>
<td>Ray Casting</td>
<td>Assignment 2 (Ray Casting) due 20/09</td>
</tr>
<tr>
<td>3</td>
<td>20/10</td>
<td>Interaction</td>
<td>Assignment 3 (Scene Graph) due 20/09</td>
</tr>
<tr>
<td>4</td>
<td>27/10</td>
<td>Geometry and Topology</td>
<td>Assignment 4 (Boundary Volume Hierarchy) due 13/10</td>
</tr>
<tr>
<td>5</td>
<td>04/11</td>
<td>Meshes</td>
<td>Assignment 5 (Meshes) due 20/09</td>
</tr>
<tr>
<td>6</td>
<td>11/11</td>
<td>Shader Pipeline</td>
<td>Assignment 6 (Shader Pipeline) due 20/09</td>
</tr>
<tr>
<td>7</td>
<td>18/11</td>
<td>Kinematics</td>
<td>Assignment 7 (Kinematics) due 15/11</td>
</tr>
<tr>
<td>8</td>
<td>25/11</td>
<td>Mass-Spring Systems</td>
<td>Assignment 8 (Mass-Spring Systems) due 29/11</td>
</tr>
<tr>
<td>9</td>
<td>02/12</td>
<td>New Developments in Computer Graphics</td>
<td>Assignment on Generative AI due 29/11</td>
</tr>
<tr>
<td>10</td>
<td>09/12</td>
<td>Animation Systems</td>
<td>Assignment 9 (Animation Systems) due 29/11</td>
</tr>
<tr>
<td>11</td>
<td>16/12</td>
<td>Computer Graphics</td>
<td>Assignment 10 (Computer Graphics) due 29/11</td>
</tr>
<tr>
<td>12</td>
<td>03/01</td>
<td>Reading Week</td>
<td>No Lecture, Reading Week</td>
</tr>
<tr>
<td>13</td>
<td>10/01</td>
<td>Simulating Characters for Games</td>
<td>Assignment 11 (Simulating Characters for Games) due 15/01</td>
</tr>
<tr>
<td>14</td>
<td>17/01</td>
<td>Midterm</td>
<td>24 hour Take home midterm (Exact date to be determined)</td>
</tr>
<tr>
<td>15</td>
<td>04/02</td>
<td>Tutorial Final Exam</td>
<td>In Tutorial Final Exam</td>
</tr>
</tbody>
</table>

**Assignments**

- Assignment 1 (Raster Images) due 20/09
- Assignment 2 (Ray Casting) due 20/09
- Assignment 3 (Scene Graph) due 20/09
- Assignment 4 (Boundary Volume Hierarchy) due 13/10
- Assignment 5 (Meshes) due 20/09
- Assignment 6 (Shader Pipeline) due 20/09
- Assignment 7 (Kinematics) due 15/11
- Assignment 8 (Mass-Spring Systems) due 29/11
- Assignment on Generative AI due 29/11
- Assignment 9 (Animation Systems) due 29/11
- Assignment 10 (Computer Graphics) due 29/11
- Assignment 11 (Simulating Characters for Games) due 15/01

**Grading**

Grading is based on assignments (8% each), quizzes (20% total), midterms (40% total), and the final exam (32% total). There will be nine programming assignments in total (8% each). Late assignments are penalized at 0.007% off for every minute late.

**Lateness Policy**

There will be nine programming assignments in total (8% each). Late assignments are penalized at 0.007% off for every minute late.

**Academic Honesty**

Academic Honesty is required reading. The term refers to the following:

- You may not purchase or copy homework assignments or exams from any source.
- You may not discuss any homework assignment with anyone other than your TA.
- You may not consult any source other than the textbook for help with homework assignments.
- You may not use any source to help you understand material covered in class.
- You may use only your own notes and memory to help you understand material covered in class.

**Assignments**

- Assignment 1 (Raster Images) due 20/09
- Assignment 2 (Ray Casting) due 20/09
- Assignment 3 (Scene Graph) due 20/09
- Assignment 4 (Boundary Volume Hierarchy) due 13/10
- Assignment 5 (Meshes) due 20/09
- Assignment 6 (Shader Pipeline) due 20/09
- Assignment 7 (Kinematics) due 15/11
- Assignment 8 (Mass-Spring Systems) due 29/11
- Assignment on Generative AI due 29/11
- Assignment 9 (Animation Systems) due 29/11
- Assignment 10 (Computer Graphics) due 29/11
- Assignment 11 (Simulating Characters for Games) due 15/01

**Exam Policies**

- No exam can be rescheduled.
- Late exams cannot be taken.
- All exam material must be returned at the end of the exam.

**Questions**

Questions of the form "I cannot find the problem with my code; here it is, can you help me" are unlikely to be replied, so don't count on it. Questions that are appropriate for all students to see/participate in. Appropriate use of the board: clarifications on assignment, on lecture material, general concerns about the course, or other remarks that are appropriate for all students to see/participate in. Appropriate use of the board: clarifications on assignment, on lecture material, general concerns about the course, or other remarks that are appropriate for all students to see/participate in.

**Use Assignment GitHub issue pages for questions/discussion**

Please do not send email directly to the TAs. They will not be replied.

**Course Policies**

Academic Honesty (required reading)

- You may not purchase or copy homework assignments or exams from any source.
- You may not discuss any homework assignment with anyone other than your TA.
- You may not consult any source other than the textbook for help with homework assignments.
- You may use only your own notes and memory to help you understand material covered in class.
- You may use only your own notes and memory to help you understand material covered in class.
- You may not use any source to help you understand material covered in class.
- You may not use any source to help you understand material covered in class.
- You may not use any source to help you understand material covered in class.
- You may not use any source to help you understand material covered in class.

**Instructor Information**

- David I.W. Levin
- In Tutorial Final Exam
- Zhecheng Wang
- Wenzhi Guo
- TAs
- diwlevin@cs.toronto.edu
- +1 416-978-2052
- csc317tas@cs.toronto.edu

**Office Hours:**

- Mondays 11:00-13:00
- Tuesdays 11:00-12:00
- Wednesdays 11:00-12:00
- Thursdays 11:00-13:00
- Fridays 1-2pm in BA5268

**Programming Resources**

Use Assignment GitHub issue pages for questions/discussion

**Security**

- Do NOT broadcast pieces of your code or answers to written assignments to the bulletin board.
- Specific or general implementation questions whose answer would benefit all students in the class are appropriate.
- However: the bulletin board is NO replacement for the class discussion forum.

**Prerequisites**