CS 480/680: Computer Graphics
3 credits (Lecture 3 + Lab 0)
Fall 2015
Last Modified: 8/19/20145

Instructor: Dr. Frederick C Harris, Jr.
- E-mail: Fred.Harris@cse.unr.edu
- Phone: (775) 784-6571
- Office: SEM 240A
- Office hours: M,W, F: 10:00am-10:50am


Teaching Assistants:
- E-mail:

Lectures:
- Monday, Wednesday, Friday: 9:00am-9:50am, AB 108

Labs:
- none

Important Notes and Dates:
- **Final Exam:** Friday December 11, 2015 2:45pm-4:45pm
- Holidays:
  - M Sept 8 (Labor Day)
  - F Oct 30 (Nevada Day-Observed)
  - W Nov 11 (Veterans Day)

Required Textbooks:

Supplemental Books:

Course Description:

**Catalog:**
Software, hardware and mathematical tools for the representation, manipulation and display of two and three-dimensional objects: applications of these tools to specific problems.

Prerequisites:

**Courses:**
- CS 302 (Data Structures).
• Math 182 (Calculus II)

Topics:
• a good working knowledge of data structures such as linked lists, trees, symbol tables, and dynamically allocated structures. You will need to know how to implement these data structures in C or C++.
• This course will also draw on knowledge of 2D and 3D geometry of vectors and coordinate systems, and on the use of matrix algebra for coordinate transformations.

Course Objective:
Students will demonstrate an understanding of concepts, algorithms, and design principles underlying 2D and 3D computer graphics, develop graphics algorithm design and implementation skills, and gain practical experience in graphics programming with OpenGL.

Course Outcomes:
The course outcomes are skills and abilities students should have acquired by the end of the course. These outcomes are defined in terms of the ABET Accreditation Criterion 3 Program Outcomes which are relevant to this course. All Criterion 3 Program Outcomes are listed in the next subsection and those relevant to this course are identified in the following Table.

<table>
<thead>
<tr>
<th>Student Outcomes</th>
<th>Course Outcomes</th>
<th>Assessment Methods/Metrics</th>
<th>Program Objectives Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Students demonstrate an understanding of the process of generating 2D objects</td>
<td>Explain the usage of 2D graphics and write a program that uses 2D graphics.</td>
<td>2,3</td>
</tr>
<tr>
<td>3</td>
<td>Students demonstrate an understanding of the process of generating images of 3D objects</td>
<td>Explain the usage of 3D graphics and write a program that uses 3D graphics</td>
<td>2,3</td>
</tr>
<tr>
<td>4</td>
<td>Students work in groups and will experience different roles (designer/implementer) with regards to their group work.</td>
<td>Group projects: peer assessment and self assessment</td>
<td>2,3,4</td>
</tr>
<tr>
<td>7</td>
<td>Students will work in groups on their final projects and present their work to an audience which will grade them.</td>
<td>Final project evaluations and group oral presentation evaluations</td>
<td>2,3,4</td>
</tr>
<tr>
<td>11</td>
<td>Students will develop algorithm design and implementation skills. Also, they will gain practical experience in graphics programming with OpenGL.</td>
<td>Write programs using OpenGL to solve a variety of problems.</td>
<td>3</td>
</tr>
</tbody>
</table>
Student Outcomes:
1. an ability to apply knowledge of computing, mathematics, science, and engineering.
2. an ability to design and conduct experiments, as well as to analyze and interpret data.
3. an ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs, within realistic constraints specific to the field.
4. an ability to function effectively on multi-disciplinary teams.
5. an ability to analyze a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
6. an understanding of professional, ethical, legal, security and social issues and responsibilities.
7. an ability to communicate effectively with a range of audiences.
8. the broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society.
9. a recognition of the need for, and an ability to engage in continuing professional development and life-long learning.
10. a knowledge of contemporary issues.
11. an ability to use current techniques, skills, and tools necessary for computing and engineering practice.
12. an ability to apply mathematical foundations, algorithmic principles, and computer science and engineering theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
13. an ability to apply design and development principles in the construction of software systems or computer systems of varying complexity.

Program Educational Objectives:
Within 3 to 5 years of graduation our graduates will:
1. be employed as computer science or computer engineering professionals beyond entry level positions or be making satisfactory progress in graduate programs.
2. have peer-recognized expertise together with the ability to articulate that expertise as computer science or computer engineering professionals.
3. apply good analytic, design, and implementation skills required to formulate and solve computer science or computer engineering problems.
4. demonstrate that they can function, communicate, collaborate and continue to learn effectively as ethically and socially responsible computer science or computer engineering professionals.

Course Topics:
- Introduction to Computer Graphics
- Graphics Software
- Basic Raster Algorithms
- Graphics Hardware
- Geometrical Transformations
- Viewing in 3D
- Curves and Surfaces
- Solid Modeling
• Achromatic and Colored Light
• Visible-Surface Determination
• Illumination and Shading
• Open GL

Course Policies:
• Students are expected to attend, and be on time, for every class. This demonstrates professionalism and consideration for your fellow students and your Instructor. While the course does not have an attendance policy, students who miss class and/or are late for class may experience an impact on their grade by missing classroom activities and/or quizzes
• Students are expected to turn in all assigned materials in a timely manner.
• Students are expected to demonstrate professionalism and courtesy by either silencing or turning off all cell phones and/or other alarm or audible indicator devices

• The Instructors reserve the right to add to, and/or modify any of the above policies as needed to maintain an appropriate and effective educational atmosphere in the classroom and the laboratory. In the case that this occurs, all students will be notified in advance of implementation of the new and/or modified policy.

UNR Athletics:
• If you are involved with any university-sponsored athletic activities that will have an impact on your attendance, please provide your Instructor with a letter from your coach and/or the UNR Athletic Department as soon as possible, but no later than the end of the second week of classes. This should include the official schedule of your activities which will impact your attendance throughout the semester.

Assignments, Examinations and Grading:
• All Formal Homework Assignments (Including exercises and Projects) and all Exams (Quizzes, Hour Exams, and the Final) are to be treated as individual and not collective efforts, unless specified otherwise. A severe penalty will be given to any assignment which indicates collusion or cheating. The usual penalty for cheating on project or an exam is failure in the course.

Homework Assignments:
• There will be a number of Homework Assignments. These consist of practice questions which are intended to assist the student in mastering the course content. Some of these assignments will be collected and graded, but you will be informed in advance when an assignment is to be handed in

Quizzes:
• There will be several announced and unannounced quizzes in lecture.

Exams:
• There will be two Midterm Exams. Both exams will be closed books, closed notes.
• Permissions to take exams on other dates than scheduled will not be given, except for extreme medical emergencies.
• All exams will take place in the regular classroom.

Programming Assignments:
• The Programming assignments require the solutions to problems using the computer. We will be using the workstations in the College of Engineering Computing Center (SEM 231). You will be instructed how to submit your projects for grading. Typically you will be asked to submit an electronic version of your code, and test runs, along with a folder with an appropriate write-up for your program.
• Projects will typically have an itemized list of topics where the undergraduates will have to do the first few (specific number identified on the project) and the graduate students have to do those plus a few more on the list (specific number again specified on the project). Those items that are not required and are completed will be graded as extra credit.

Late Submission Policy:
• Projects will be collected at the start of the class session in which they are due. A programming assignment turned in after collection is done will be graded as late.
• The penalty for late assignments and projects will be as follows: max(10%, n^2%), where n is the number of school days.

Grading Structure:
• The final grade will be based on (Tentative, subject to change):

<table>
<thead>
<tr>
<th>Section</th>
<th>480</th>
<th>680</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance/Participation/Homework</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Projects</td>
<td>50%</td>
<td>45%</td>
</tr>
<tr>
<td>Midterm Exams</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Presentation</td>
<td></td>
<td>5%</td>
</tr>
</tbody>
</table>

Important Notes:
• I will be using a +/- grading system.
• At the end of the semester (during the final exam period) a CD will be due with an electronic version of all projects and write-ups.
• Every project must be completed, working, and turned in. For each project that is not, the final grade in the course may be lowered.

Academic Integrity:
Students are encouraged to study together, however each student must individually prepare his/her solutions. Cheating or plagiarism are not permitted and will be sanctioned according with the UNR policy on Academic Standards. You should carefully read the section on Academic Dishonesty found in the Policies section of the Office of Student Conduct. (copies of this section
are on-line at http://www.unr.edu/student-conduct/policies/university-policies-and-guidelines/academic-standards/policy). Your continued enrollment in this course implies that you have read it, and that you subscribe to the principles stated therein.

**Supplemental Instructions for 400-600 Courses:**

- As stated previously, Projects will typically have an itemized list of topics where the undergraduates will have to do the first few (specific number identified on the project) and the graduate students have to do those plus a few more on the list (specific number again specified on the project). Those items that are not required and are completed will be graded as extra credit.

- Graduate Students are also to read a paper which discusses a facet of Computer Graphics. This paper should appear in a respectable journal or conference such as those published by ACM or IEEE. You will do a presentation in class similar to a conference presentation in our field. Your presentation will be 15 minutes in length followed by 5 minutes of question/answer.

**Academic Success Services:**

Your student fees cover usage of the Math Center (784-4433 or www.unr.edu/mathcenter/), Tutoring Center (784-6801 or www.unr.edu/tutoring/), and University Writing Center (784-6030 or www.unr.edu/writing_center). These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student.

**Disability Statement:**

If you have a disability for which you will need to request accommodations, please contact me or someone at the Disability Resource Center (Thompson Building, Suite 101), as soon as possible to arrange for appropriate accommodations.

**Class Recording:**

Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.