CS488/688 - Introduction to Computer Graphics - Winter 2022
School of Computer Science, University of Waterloo

Instructor: Gladimir V. G. Baranoski, Office DC3520.
Lecture Times: Tuesday and Thursday, from 8:30-9:50, MC4063.

Schedule

Week	Date	Quizzes/Assignments/ Final Assessment
3	January 20, Thursday	Assignment A0
4	January 26, Wednesday	Quiz Q0, Quizzes Integrity Statement
5	February 3, Thursday	Assignment A1
6	February 9, Wednesday	Quiz Q1
7	February 17, Thursday	Assignment A2
9	March 2, Wednesday	Quiz Q2
10	March 10, Thursday	Assignment A3
11	March 16, Wednesday	Quiz Q3
12	March 24, Thursday	Assignment A4
13	March 30, Wednesday	Quiz Q4
14	April 4, Monday	Assignment A5
14	April 5, Tuesday	Release of Final Assessment Guidelines

Important Notes:

- The deadline for the submission of assignments and integrity statement is **8AM ET** on the days specified above as their due dates.

- Late assignment submissions (up to 24h from the specified deadline) will receive a penalty of -2 marks. Assignments submitted after 24h from the specified deadline will receive **ZERO** marks. **No support** will be provided for assignments during the 24h penalty period. If a student choses to make a submission close to the end of the 24h period and the submission fails for any reason, **no extra time** beyond the 24h will be given.

- Assignments whose marking require any corrective action from the course staff to address student's submission mistakes (e.g., missing files, files with incorrect names and/or permissions, problems with makefiles etc.) will also be treated as late assignments. If the corrective action takes more than 15 minutes, then the assignment will receive **ZERO** marks. Otherwise, the assignment will receive a penalty of -2 marks.

- Students will be required to submit a signed declaration with each of their assignments. Assignments submitted without a signed declaration will receive a **ZERO** marks.

- **Course Staff**

  - Instructor:
    * Gladimir V. G. Baranoski (gvgbaran@uwaterloo.ca). Office hours to be held on Fridays, in DC3520, at 5PM ET.
  - Teaching Assistants (TAs):
    * Xiang Fang (x2fang@uwaterloo.ca). Office hours to be held on Mondays at 3PM ET.
    * Spencer R. Van Leeuwen (srvanlee@uwaterloo.ca). Office hours to be held on Wednesdays at 2PM ET.

  Note: During this term, there will be one-on-one virtual meetings (**virtual office hours** or **VOH**) between students and the course staff. Detailed information about the registration and participation in these VOHs will be provided via **Learn** in the first week of classes.

1. **Course General Resources**

   - Learn
   - Piazza: `https://piazza.com/uwaterloo.ca/Winter2022/cs488`
   - General website:
     `http://www.student.cs.uwaterloo.ca/~cs488/Winter2022/index.html`
   - Lessons website:
     `http://pedrinho.cs.uwaterloo.ca/~gvgbaran/CS488/Winter22/CS488-W22.html`
     - The access to the lessons website is password protected.
     - The password will be released via **Learn** during the first week of classes.
     - The password may be subject to change during the term. In that case, the new password will also be released via **Learn**.

2. **Course Description**

   Software and hardware for interactive computer graphics. Implementation of 3-D transformations, clipping, and projection routines. Data structures, hidden surface removal, colour shading, ray tracing and additional topics if time permits.

3. **Course Objectives**

   At the end of the course, students should be able:

   - to write interactive 3D computer graphics programs;
   - to understand how linear and perspective transformations are used in modeling and rendering in 3D computer graphics;
   - to understand the processes of clipping, hidden surface removal, shading and other rendering techniques;
   - to write a simple ray tracer.

4. **Required Reading Materials**

   - CS488/688 Course Notes available in the course general website and selected reading materials (handouts) to be made available in the course Lessons website. For this offering (Winter 2022), due to the current special circumstances, suggested reading materials provided within the course notes should be ignored. For additional reading materials, please refer to the next section.

5. **Additional Reading Materials**

   - A list of selected e-books covering course contents is available through to library course reserves for CS488, Winter 2022. To access these books, students can use either the course reserves link in Learn or the course reserves link on the library website.

6. **General Overview of Topics**

   - The Graphics Environment
   - Mathematical Underpinnings
   - Transformations

- Hidden Surfaces and Shading
- Ray Tracing
- Realistic Rendering
- Splines
- Animation

7. **Marking Scheme**

- Programming component:
  - Assignments: 50%
- Examination component:
  - Quizzes: 20%
  - Final assessment: 30%
- General notes:
  - Students must average at least a 50% in both the programming and examination components of the course to pass. Bonus marks obtained in one component are not carried over to the other component. If a student fails to obtain a passing grade on either component, his/her **final grade** is going to be the **grade obtained in that failed component.**
  - The instructor reserves the right, where appropriate, to adjust raw marks downward in the case of cheating and upward in other situations.

8. **Assignments**

- There will be six assignments (A0 to A5) spread throughout the term. Their specifications will be provided in the course general website.
- A0 is optional. Although it will not be considered in the computation of the course final grade, its submission is recommended so that students can resolve any issue regarding assignment submission procedures.
- A1 to A5 have the same weight.
- The assignments employ several code libraries (*e.g.*, OpenGL, ImGUI, etc.) whose behaviour can vary depending on the computing environment (*e.g.*, OS, drivers, etc.). To ensure that the behaviour of the students' assignment code is the same on the machines used by the TAs to grade the assignments, students will be provided with a virtual machine image of Ubuntu on Piazza in the first week of the course. The TAs will run all assignments on the provided virtual machine using Virtual Box. It is the students' responsibility to ensure that their assignment code compiles and runs in the provided virtual machine using Virtual Box. It is also the students' responsibility to make sure that they have access to hardware off campus (*e.g.*, a desktop PC or a laptop) capable of running the assignment code in the provided virtual machine.
- During the Winter 2022 term, students may wish to use the undergraduate graphics lab (MC 3007) machines to do their assignments. The lab will be closed at the beginning of the term, but we hope that we can reopen the lab once in-person classes start. However, special circumstances related to the COVID pandemic may further interrupt access to lab resources later in the term. Thus, students should **not** expect to rely on the lab computers to complete their assignments.
- Regarding lab safety guidelines, students should follow those to be posted in the lab by CSCF personnel.
- Although supporting information about software tools (*e.g.*, OpenGL and Lua) to be used in the assignments will be made available to the students in the course websites, it is also their responsibility to be able to employ these tools during the term.

9. **Quizzes**

   - There will be five quizzes (Q0 to Q4) spread throughout the term. The quizzes will be made available via **Learn** on the dates specified in the course schedule. Guidelines for taking the quizzes, including the submission of an integrity statement, will be provided via **Learn** and they will also be available in the course Lessons website.

   - Q0 is optional. Although it will not be considered in the computation of the course final grade, its submission is recommended so that students can resolve any issue regarding quiz submission procedures. Q1 to Q4 have the same weight.

   - The quizzes will be based on the required reading materials.

   - Students should submit the quizzes integrity statement by **January 26 , 8AM ET**. Students that do not submit a valid integrity statement by the specified deadline will not be allowed to access the quizzes. Submission of integrity statement during the quizzes availability period will **NOT** be accepted.

   - Quizzes that are not submitted during their availability period will receive **ZERO** marks, and their availability period (including Q0) will **NOT** be extended.

10. **Course Delivery Approach**

    - For this offering (Winter 2022), we plan to have in-person lectures. Due to special circumstances, the instructor will also release in the course Lessons website required reading materials equivalent to the contents covered in each lecture. These materials can be regarded as illustrated transcripts of the traditional lectures. The contents equivalent to a lecture will be released on Tuesdays, and the contents equivalent to another lecture will be released on Thursdays. In both cases, these materials will be made available after the respective lectures.

    - For specific questions directly related to the required reading materials, students should attend the instructor's office hours.

    - It is the students' responsibility to read the indicated required materials before meeting with the instructor. The instructor reserves the right, where appropriate, to disregard questions whose answers can be directly found in the required reading materials or questions involving topics to be covered in subsequent Lessons whose required reading materials have not yet been indicated in the course Lessons website.

    - During periods in which in-person lectures need to be cancelled, the aforementioned procedures will be adjusted accordingly. For these adjustments, please refer to Section 14 below.

11. **Course Communication Policies**

    - Assignment-related announcements from the course staff will be provided using Piazza. Piazza posts not directly related to the assignments will be removed.

    - Students should use public Piazza posts only for general questions about assignments that may be of interest to other students in the course. Assignment implementation details (such as code particulars) must be addressed via private Piazza posts. A breach of this guideline will also be considered a violation of academic integrity and it will be dealt with according to the university procedures described in in Policy 71, Student Discipline: *www.adm.uwaterloo.ca/infosec/Policies/policy71.htm*.

    - **All other course-related announcements** from the course instructor will be provided using **Learn**. **It is the students' responsibility to ensure that they are up-to-date on reading these announcements.**

    - General questions about the contents of this course outline should be addressed to the instructor during his office hours within the first two weeks of classes.

    - If a student has any concern about the course delivery procedures and polices, such a concern should be addressed directly with the instructor during his office hours. **Piazza should NOT be used as a complaint forum, and posts along those lines will be removed.**

- Use the course staff's email for specific issues (*e.g.*, questions about the marking of submitted work) pertaining only to you.
- **Issues requiring detailed answers should be addressed during course staff's office hours.**

12. **Quiz and Assignment Policies**

    - Questions directly related to assignments should be directed to the TAs as instructed in the remainder of this section.
    - Quizzes and assignments must be done individually and submitted via **Learn**. In case of any issue related to their submission procedures, the student must contact the TAs before the day scheduled for the activity (assignment or quiz) using the appropriate means indicated below.
    - **No messages or other information related to the quiz questions or answers should be posted in Piazza or shared using other electronic means.** Any breach of these guidelines will be considered a violation of academic integrity and it will be dealt with according to the university procedures described in Policy 71, Student Discipline: *www.adm.uwaterloo.ca/infosec/Policies/policy71.htm.*
    - Students should attend the instructor's office hours to address concerns with respect to the marking of quizzes within two weeks of the date it was first returned to the students.
    - Students should contact the TAs about concerns with respect to the marking of assignments within two weeks of the date it was first returned to the students. If the issues cannot be resolved between the TA and the student, the TA will inform the instructor, who will make the final decision.
    - In case of a special hardware or software issue preventing a student to submit an assignment or quiz by its due date, the student must contact the TAs **at least 24h before** that deadline.
    - Due to the relatively intense sequence of course assignments, any deadline extension would only transfer and possibly magnify an issue by reducing the time available for the next assignment. Also, no assignment due date can be extended to the exam period due to university regulations. Thus, extensions are **NOT** going to be granted. Since this course is not mandatory, students should consider very carefully taking it or not the course this term, particularly if they already are planning to take several courses and have other time constraints.
    - In case of a medical issue preventing a student to submit an assignment or quiz by its due date, the student should promptly notify the course instructor (before the assignment or quiz due date) and provide the appropriate documentation.
    - Students that do not have access to any of the resources required to participate in this course (*e.g.*, Piazza, Learn, VirtualBox, etc..) should contact course staff within the first two weeks of classes to address the situation. Students that enrol in the course after January 20 should contact the course staff no later than January 26.

13. **Final Assessment Guidelines**

    - The final assessment guidelines will be released on the date specified on the course schedule. Format and contents of the final assessment will **not** be discussed before that.

14. **Continuity Plans**

    - In case of a short-term or long-term cancellation of in-person classes, as mentioned in Section 10 above, the instructor will also release in the course Lessons website required reading materials equivalent to the contents covered in each lecture. We remark that these materials can be regarded as illustrated transcripts of the traditional lectures. The contents equivalent to a lecture will be released on Tuesdays, and the contents equivalent to another lecture will be released on Thursdays. After the release of the

materials for a given Lesson, an announcement will be posted on **Learn** and an email notification will be send to the students.

- During periods in which in-person lectures need to be cancelled, students that have specific questions about the required materials can send an email to the instructor (using the address gvgbaran@uwaterloo.ca, with the subject "CS488/688: Lessons Question"). For questions requiring detailed answers, the instructor will indicate that student should register and attend his virtual office hours (VOH).

- In case of a short-term or long-term cancellation of in-person meetings, the instructor office hours will be held online, with instructions to be provided via **Learn**.

- Course quizzes and final assessment will be carried out online via **Learn**, with instructions to be provided on the course website and also via **Learn**.

15. **University Mandatory Information**

- **Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check *www.uwaterloo.ca/academicintegrity/* for more information.]

- **Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Stud. Petitions and Grievances, Sec. 2, *www.adm.uwaterloo.ca/infosec/Policies/policy70.htm*. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

- **Discipline:** A student is expected to know what constitutes academic integrity [check *www.uwaterloo.ca/academicintegrity/*] to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (*e.g.*, plagiarism, cheating) or about 'rules' for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, *www.adm.uwaterloo.ca/infosec/Policies/policy71.htm*. For typical penalties check Guidelines for the Assessment of Penalties, at the following web site:
www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

- **Appeals:** A decision made or penalty imposed under Pol. 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals): *www.adm.uwaterloo.ca/infosec/Policies/policy72.htm*.

- **Note for Students with Disabilities:** The AccessAbility Services Office (AAS), located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AAS at the beginning of each academic term.