COMP3170
Computer Graphics
Session 1, Weekday attendance, North Ryde 2020

Department of Computing

Coronavirus (COVID-19) Update
Due to the Coronavirus (COVID-19) pandemic, any references to assessment tasks and on-campus delivery may no longer be up-to-date on this page.
Students should consult iLearn for revised unit information.

Find out more about the Coronavirus (COVID-19) and potential impacts staff and students

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https://unitguides.mq.edu.au/unit_offerings/123659/unit_guide/print 1
General Information

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Contact via Email
Email for appointment

Credit points
10

Prerequisites
130cp at 1000 level or above including (COMP2110 or COMP249) or COMP2160 or (COMP2000 or COMP229)

Corequisites

Co-badged status

Unit description
This unit is the study of pictures, images and animations generated by computers, as well as tools used to produce these pictures. This unit introduces the mathematical foundations of computer graphics, examines how to model three-dimensional objects, introduces techniques for creating animations, and explores how realistic scenes are rendered. Practical work involves using a graphics library, such as OpenGL, under Unix or Windows platforms.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are available at https://students.mq.edu.au/important-dates

Learning Outcomes
On successful completion of this unit, you will be able to:

ULO2: Program 2D and 3D graphical applications using OpenGL embedded in a programming language (such as OpenGL in Java)

ULO3: Apply vector geometry to implement and combine 3D transformations including
rotation, translation, scale and perspective.

**ULO4:** Program vertex and fragment shaders to implement effects such as lighting, texturing, shadows and reflections.

**ULO1:** Understand the fundamentals of vector geometry and employ them in devising algorithms to achieve a variety of graphic effects.

**ULO5:** Explain the core concepts behind advanced graphics techniques such as ray-casting and indirect lighting.

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**Assessment Tasks**

**Coronavirus (COVID-19) Update**

Assessment details are no longer provided here as a result of changes due to the Coronavirus (COVID-19) pandemic.

Students should consult iLearn for revised unit information.

Find out more about the Coronavirus (COVID-19) and potential impacts staff and students.

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**Delivery and Resources**

**Coronavirus (COVID-19) Update**

Any references to on-campus delivery below may no longer be relevant due to COVID-19.

Please check here for updated delivery information: https://ask.mq.edu.au/account/pub/diplay/unit_status

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**Classes**

Each week you should attend three hours of lectures. Each week you should also attend your two hour mixed workshop class (the first hour of this class is supervised and includes tutorial material; the second hour is unsupervised practical time). For details of days, times and rooms for classes consult the timetables webpage. Note that mixed workshop classes commence in week 1. You should have selected a mixed workshop class during enrolment. You should attend the mixed workshop class which you are enrolled in. If you do not have a class, or if you wish to change one, you should follow the usual procedures for change of enrolment. Please note that you are expected to attend your mixed workshop class - this is the first place to obtain help with the unit.

**Resources to assist your learning**

iLearn is your first place to visit for weekly unit information including lectures, workshops, assignment specifications, discussion forums and other resources.

Echo360 Lecture Recordings and live lecture streaming are available - for more information, see the Echo360 student guide. If using lecture recordings, be sure to keep up to date with the
lectures each week. The lectures will present material that is relevant to assignments and
workshops, so keeping up with lectures is important for your progress in the unit.

The required textbook for this unit is *Computer Graphics Programming in OpenGL with Java* 2nd
edition, by V. Scott Gordon and John Clevenger, 2019. This textbook is available for purchase
through [Booktopia](https://www.booktopia.com.au/) (which has acquired the University Coop Bookshop). It is also available as an
ebook in the library.

There are a number of online resources about OpenGL. You can use [http://www.opengl.org/](http://www.opengl.org/), as
your starting point or use Google to look for specific items. The JOGL interface to OpenGL is
described at [https://jogamp.org/](https://jogamp.org/).

**Technology used and required**

We will use Java JDK, Eclipse and JOGL to develop and debug OpenGL programs. See iLearn
for more details.

**Websites**

We will be using the University's online learning system iLearn. Students should check
COMP3170 on iLearn regularly for updates.

**Discussion Boards**

We will use the forums hosted within iLearn. Feel free to post questions there. Important
announcements (such as tips and clarifications on assignments) will often be posted there.

**Teaching and learning strategy**

COMP3170 is taught via lectures in a lecture room and live streamed, and mixed workshop
classes in a laboratory. The work you do and the feedback that you receive play a crucial role in
your learning. Lectures are used to introduce new material, give examples of the use of
programming methods and techniques and put them in a wider context. Furthermore, to highlight
the relationship between teaching, research and learning, an advanced topic will occasionally be
introduced during the lectures. This additional material will not be examined as such but may
prove useful to complete the assignments.

You learn by processing concepts, not just by hearing them. Mixed workshop classes are small
group classes in the laboratories which give you the opportunity to do exactly that by interacting
with a tutor who has a sound knowledge of the subject and with your peers. This also gives you
a chance to practice your programming skills. You have many opportunities to seek and to
receive feedback. During lectures, you are encouraged to ask the lecturer questions to clarify
anything you might not be sure of. Each week, you will be given problems to solve in the mixed
workshop classes. The discussion and the solutions provided will help you to understand the
material in the unit, to do the work for the assignments, and to prepare you for the final exam. It
is important that you keep up with these problems every week. Each week you should:

- Attend lectures, take notes, ask questions
- Study the on-line lecture slides/notes and textbook as directed by the lecturer
- Attend your mixed workshop class and seek feedback from your tutor on your work
• Attempt the weekly online quiz and study/seek assistance with any questions that you do not know how to answer correctly
• Start working on any assignments as soon as they have been released.

Time management and programming

COMP3170 is a ten credit point unit. You are therefore expected to spend approximately ten hours per week on this unit, including the study break weeks - 150 hours in total. Since each week each student should attend three hours of lectures, and attend a two hour mixed workshop, the remaining five hours per week will be spent on private study and assigned assessable work outside of class. A significant portion of the outside time will be spent on programming. Mastering some basic skills early in the semester can save you tenfold in time and energy. In particular, many students have difficulty managing large projects and have problems with some of the trickier aspects of OpenGL in Java. The textbook provides a good introduction to OpenGL and JOGL - read it!

You cannot learn graphics programming - or any kind of programming for that matter - simply by reading a textbook. You could make a start by copying some of the programs from the unit website, then modifying and running the programs to gain an understanding of how they work. Make sure you try to understand each line of code. Programming is a science and an art; it is not magic. The assignments in this unit could take many hours to complete. Don't expect to complete any of the assignments over a single weekend. Start each assignment early, get some basic functionality going, and try to become proficient in the parts of OpenGL that will be necessary for the assignment. It is often a good idea to write sample programs that let you test a single feature you are exploring before embedding it in the large project.

Unit Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction: Techniques and applications of computer graphics; GPU; first programming examples.</td>
</tr>
<tr>
<td>2</td>
<td>2D Basics: 2D coordinate systems and transformation between them - world coordinates, Normalised Device Coordinates and viewport coordinates. 2D graphics programming examples.</td>
</tr>
<tr>
<td>3</td>
<td>2D Transformations: Vectors and matrices; 2D transformation matrices and how to use them.</td>
</tr>
</tbody>
</table>

The provisional schedule of lecture content is as follows. Changes may be made as the session progresses and will be seen on iLearn.

Coronavirus (COVID-19) Update

The unit schedule/topics and any references to on-campus delivery below may no longer be relevant due to COVID-19. Please consult iLearn for latest details, and check here for updated delivery information: https://ask.mq.edu.au/account/pub/display/unit_status
<table>
<thead>
<tr>
<th>Week</th>
<th>Topics Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2D Camera: Scene graph and placing the camera in the scene; drawing circles and Bezier curves.</td>
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<tr>
<td>5</td>
<td>3D Transformations and Meshes: Extending transformation matrices to 3D; rotations in 3D; introducing fragment shaders.</td>
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<tr>
<td>6</td>
<td>3D Camera and Perspective: The projection matrix and perspective divide;</td>
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<tr>
<td>7</td>
<td>Rasterisation - from Models to Pixels</td>
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<td></td>
<td>Break</td>
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<td>8</td>
<td>Depth buffer and transparency</td>
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<tr>
<td>9</td>
<td>Shading and illumination</td>
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<tr>
<td>10</td>
<td>Shading and texturing</td>
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<tr>
<td>11</td>
<td>Texturing</td>
</tr>
<tr>
<td>12</td>
<td>Effects</td>
</tr>
<tr>
<td>13</td>
<td>Revision</td>
</tr>
</tbody>
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### Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central ([https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central)). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- **Special Consideration Policy** *(Note: The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Students seeking more policy resources can visit the Student Policy Gateway ([https://students.mq.edu.au/support/study/student-policy-gateway](https://students.mq.edu.au/support/study/student-policy-gateway)). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central ([https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central)).
Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/study/getting-started/student-conduct](https://students.mq.edu.au/study/getting-started/student-conduct)

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit [ask.mq.edu.au](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

Student Support

Macquarie University provides a range of support services for students. For details, visit [http://students.mq.edu.au/support/](http://students.mq.edu.au/support/)

Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- **Workshops**
- **StudyWise**
- **Academic Integrity Module for Students**
- **Ask a Learning Adviser**

Student Enquiry Service

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

Equity Support

Students with a disability are encouraged to contact the [Disability Service](mailto:) who can provide appropriate help with any issues that arise during their studies.

IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/)

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/). The policy applies to all who connect to the MQ network including students.

Changes from Previous Offering

The 2020 offering of Computer Graphics will use OpenGL/Java, whereas the 2019 offering used WebGL/Javascript. Material on shader programming in GLSL is similar in 2020 to that taught in
2019.

The textbook is new in 2020.

**Changes since First Published**

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/02/2020</td>
<td>Revised information about textbook because Booktopia has acquired University Coop Bookshop. Also, emphasise that the textbook is required in this unit.</td>
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</tbody>
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