

COURSE NAME: GDD401 Development for Scalability

Credit Value: 4
Total Course Hours: 56
Prerequisite Course(s): None
Corequisite Course(s): None

COURSE DESCRIPTION

This class will teach students how to efficiently write scalable code that can function on a wide range of hardware, from mid-tier mobile phones to current generation gaming hardware to high end desktop PCs. Common scalable techniques will be taught, including writing event-based systems, threading / job systems, and proper use of update loops. Common performance bottlenecks and their solutions will be identified, such as nested loops, recursion, state checking every frame, etc.

LAND ACKNOWLEDGEMENT

Canadore College resides on the traditional territory of the Anishinaabeg and within lands protected by the Robinson Huron Treaty of 1850. This land is occupied by the people of Nipissing First Nation since time immemorial.

PLAR INFORMATION

This course is not eligible for Prior Learning Assessment and Recognition.

COURSE LEARNING OUTCOMES

Upon completion of this course, the student will have reliably demonstrated the ability to:

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| <p>1.0 Appraise best practices in creating scalable code.</p> <ul style="list-style-type: none">1.1 Discuss the update loop, and how minimizing its use aids in creating flexible codebases that can be deployed on lower end devices.1.2 Describe the efficiency of practices such as finding components / game objects at runtime, try/catch blocks, etc.1.3 Demonstrate ability to write event-based systems and delegates.1.4 Demonstrate ability to unload assets when not in use.1.5 Discuss how garbage collection and memory management work. <p>2.0 Analyze the basics of threading.</p> <ul style="list-style-type: none">2.1 Discuss when it is beneficial to send work to a thread.2.2 Describe the difference between threads and tasks.2.3 Demonstrate ability to successfully start and stop threaded work.2.4 Demonstrate ability to lock and unlock | <ul style="list-style-type: none">objects to create thread safe operations.2.5 Demonstrate ability to create threads that send parameters to the threaded function. <p>3.0 Evaluate technical considerations of games targeting PC / console.</p> <ul style="list-style-type: none">3.1 Describe various shader types, their impact on performance, how to choose correct shaders for models for maximum performance.3.2 Analyze the abilities and limitations of various PC hardware architectures, including an understanding of various graphics APIs, features and abilities of these graphics APIs, technical specifications of current generation console hardware, and the limitations these hardware configurations.3.3 Describe common techniques that can be employed to provide scalable options for players on lower end hardware.3.4 Demonstrate ability to create and interface with an input module that can accept multiple input types, such as joystick, mouse and keyboard, etc. <p>4.0 Evaluate technical considerations of games</p> |
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targeting mobile.

- 4.1 Demonstrate ability to modify input for touch-based control schemes.
- 4.2 Discuss mobile-optimized shaders, as well as shaders generally considered extremely performant on lower end hardware.
- 4.3 Demonstrate ability to optimize use of dynamic lighting / rendering in mobile, and how to effectively bake and compress non-realtime light and shadow maps.
- 4.4 Analyze the impact of high-resolution textures, ability to resize and selectively remove unnecessary maps where possible.
- 4.5 Recognize the performance impact of particle systems, and how to limit their use.
- 4.6 Recognize the performance impact of full screen image post processing techniques in mobile games, as well as understanding which of these common effects are most performant in a mobile environment.
- 4.7 Discuss the unique challenge of transparent materials on mobile devices.

5.0 Evaluate technical considerations of games targeting virtual Reality.

- 5.1 Appraise common input techniques used in the creation of VR games, such as controller pointing, buttons, gaze, etc.
- 5.2 Analyze limitations of post processing in VR, as well as its performance cost.
- 5.3 Describe the performance implications of various VR rendering options, such as multi-

pass, single-pass, and stereo instancing.

5.4 Experiment with the impact of shaders in VR, as well as common VR-friendly alternatives to common shaders.

5.5 Demonstrate ability to reduce draw call counts via previous described methods, as well as geometry batching, light baking, texture downscaling, etc.

5.6 Describe the critical importance of maintaining a high framerate in VR for the sake of player comfort.

6.0 Evaluate technical considerations of games targeting augmented / mixed reality.

6.1 Experiment with common input techniques used in the creation of AR / MR games, such as controller pointing, buttons, gaze, etc.

6.2 Experiment with mobile-optimized and extreme low-end shaders.

6.3 Demonstrate ability to light and render a scene with minimal / no dynamic lights, lightmap compression techniques, setting real-time light settings.

6.4 Demonstrate skill with common techniques that can be used to quickly optimize models and textures, removing all textures that are not critically important.

6.5 Discuss post processing in AR / MR, it's feasibility in current generation hardware.

6.6 Discuss transparent materials, their uses and limitations in an AR / MR projects.

GENERAL EDUCATION

This is not a General Education course.

PROGRAM OUTCOMES

This course contributes to the following Ministry of Colleges and Universities approved program learning outcomes (PLO):

Game- Design and Development

- 1. Analyze the difference in game genres in order to develop games that meet the needs of specific markets.
- 3. Support the development of games by identifying and relating concepts from a range of industry roles - programming, design, and art.
- 6. Perform all work in compliance with relevant statutes, regulations, legislation, industry standards and codes of ethics.

7. Use game concepts to support the ongoing iteration, creation, design and development of games.
9. Develop evolving and iterative game design documents that align with standard industry expectations and/or company practices.
10. Conceive, prototype, develop, test and evaluate procedures for the ongoing iteration, creation, design and development of games.
13. Apply practical game design elements to support the ongoing iteration, creation, programming, design and developing of unique gaming environments, levels, characters, assets and props.
14. Apply programming principles and techniques to create operational games or game components.
19. Conceive, prototype, develop, test and evaluate procedures for the creation, design, programming, production and testing of games in a group environment.

ESSENTIAL EMPLOYABILITY SKILLS OUTCOMES

This course contributes to the following Ministry of Colleges and Universities approved essential employability skills (EES) outcomes:

4. Apply a systematic approach to solve problems.
5. Use a variety of thinking skills to anticipate and solve problems.
6. Locate, select, organize, and document information using appropriate technology and information systems.
7. Analyse, evaluate, and apply relevant information from a variety of sources.

EXTERNAL COURSE ACCREDITATIONS AND CONDITIONS

There are no external accreditations or conditions identified for this course.

COURSE EVALUATION

Evaluation Item	Weight
Tests and Quizzes	20%
Assignments	40%
Labs/Studies	40%

COURSE PASS GRADE

50

GRADING SYSTEM

A+: 90-100%	B+: 77-79%	C+: 65-69%	D: 50-54%	S - Satisfactory
A: 85-89%	B: 73-76%	C: 60-64%	F: 0-49%	I - Incomplete
A-: 80-84%	B-: 70-72%	D+: 55-59%		F- Repeat Course, included in GPA
				FS- Failure Supplemental
				FR- Repeat course, excluded from GPA

*For a complete chart of grades and descriptions, please see the Grading Policy.

LEARNING RESOURCES

No textbooks have been identified for this course.

Additional Learning Resources:

N/A

Please see the [Campus Bookstore](#) to verify the current textbook costs and your [program page](#) for additional program fees and/or learning material requirements (see the "Tuition Fees" and "What You Need" sections).

Resources listed on the course outline support the achievement of learning outcomes, and may be used throughout the course to varying degrees depending on the instructor's teaching methodology and the nature of the resource.

Technology requirements - <https://www.canadorecollege.ca/BYOD>

The Harris Learning Library's staff can help you find resources to support your learning - <https://www.canadorecollege.ca/harris-learning-library>.

LEARNING ACTIVITIES

In Class instruction/discussion

Instructor demonstration

Individual hands-on practice

In-class assignments

DELIVERY MODE

This course may be delivered, in whole or in part, in a number of modalities, including In-Person, Remote (synchronous and/or asynchronous), hybrid, or Hyflex, as per accreditation and/or regulatory standards where appropriate. This information is identified on the course schedule (student and faculty).

RECORDING GUIDELINES

This class may be recorded by faculty of the College. Faculty will inform students when recording of the class commences and ceases. 'Recorded' means that the audio-visual and chat portions of the class will be recorded and then be stored on the College or vendor provider server. They will be made available to students, but only for the express and sole use of those registered in this course. If you have any questions or concerns about this recording, please contact your instructor or the College's privacy officer at privacy.officer@canadorecollege.ca.

Full recording guidelines can be found at: <https://cdn.agilitycms.com/canadore-college/academic-centre-of-excellence/Canadore%20Recording%20Guidelines.pdf>. Recordings are to be managed (or removed) as per the College's Recording Guidelines following the completion of the course.

EXPERIENTIAL LEARNING

All full-time programs of study at Canadore College strive to provide students with the opportunity for experiential learning. This course provides students with an experiential learning opportunity through:

Workplace/Lab Simulation (EL)

ACADEMIC POLICIES

Canadore College is committed to the highest standards of academic integrity, and expects students to adhere to these standards as part of the learning process in all environments. The College's Academic Integrity policy seeks to ensure that all students understand their rights and responsibilities in upholding academic integrity and that students receive an accurate and fair assessment of their work. Please review the Academic Integrity policy (A-18) and other academic policies found on our website: <https://www.canadorecollege.ca/about/policies>.

COLLEGE POLICIES

- Protecting human rights in support of a respectful college community

For college policies please see: <http://www.canadorecollege.ca/about-us/college-policies>.

Accessibility Learning Services for Students with Disabilities - Student Success Services

Student Success Services provides comprehensive support to students. We aim to ensure that all students have equal access to educational opportunities and can succeed in their academic journey. Our services focus on reducing and eliminating barriers related to education through individualized accommodations and support. If you are a student with a disability, we encourage you to register with Accessible Learning by completing the Student Success – Accessible Learning Services Form (https://canadorecollege-accommodate.symplicity.com/public_accommodation/).

For more detailed information about the services offered, please visit our webpage: <https://isucceed.canadorecollege.ca/students>. To connect with Student Success Services email studentsuccessnow@canadorecollege.ca or call 705.474.7600 ext 5205.

FIRST PEOPLES' CENTRE:

A culturally supportive and comfortable environment where you can study, socialize, and access a wide range of resources and confidential student focused services.

- Counselling services
- Elders on Campus and Cultural Advisors
- Cultural and Spiritual Wellness
- Peer tutoring/Peer Mentorship
- wholistic support network
- Social events and workshops on study skills, self-care & life skills

Drop by our offices at C254 College Drive, W103 Commerce Court or Call 705-474-7600 Ext. 5961

<https://www.canadorecollege.ca/first-peoples-centre>

WAIVER OF RESPONSIBILITY

Every attempt is made to ensure the accuracy of this information as of the date of publication. The college reserves the right to modify, change, add, or delete content.

HISTORICAL COURSE OUTLINES

Students use course outlines to support their learning. Students are responsible for retaining course outlines for future use in applications for transfer of credit to other educational institutions.