**MEMORIAL UNIVERSITY OF NEWFOUNDLAND**
**Department of Computer Science**

# Computer Science 4303 – Winter 2022
# Artificial Intelligence for Computer Games


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**Course Website:** http://www.cs.mun.ca/~dchurchill/teaching.shtml
(most course activity will take place on D2L)

**Course Objectives:**

This is a course for students interested in learning about various techniques for Artificial Intelligence in Computer Games. Topics include an introduction to: movement in games, search and planning, decision making, and procedural content generation. Implementation of course assignments will be done using the C++ programming language and the SFML graphics library. A final course project will be to implement an AI bot for a retail video game.

**Course Outline:** (not in order of instruction)

- Introduction to C++ / SFML (1 Assignment)
  - C++20 Syntax, Semantics, STL, Compiling, SFML Basics
- Introduction to Game AI
  - What is Game AI and why does it matter?
  - Why it is different from "Academic" Artificial Intelligence
- Movement in Games (1 Assignment)
  - Space Representations (Grids, Graphs, Triangulation)
  - Planning / Search
  - Vector Fields / Influence Maps
  - Steering / Smoothing Movement / Collision Avoidance
- Procedural Content Generation (PCG) (1 Assignment)
  - Maze Generation / Map Representation
  - Map Generation (Rule-Based, BSP, Cellular Automata)
  - Terrain (2D / 3D) (Generation / Smoothing / Fractals)
  - Grammars for PCG (Trees / L-Systems)
- Decision Making
  - Finite State Machines
  - Behavior Trees
  - Utility Theory
  - Two-Player Search (Minimax / Alpha-Beta / MCTS)
- Game AI Competitions / Bot Creation (Project)
  - Intro to Game AI Competitions
  - Game AI Bot Case Study and Analysis (Starcraft / Prismata)
  - Final Project: Create an AI Competition Bot

**Textbook:** Beginning C++ Through Game Programming http://a.co/d/2Ts1N4P
(optional) CPP Reference https://en.cppreference.com/

**Format:** 2 lectures per week, Tuesday / Thursday (2:00pm to 3:15pm)

**Evaluation:**

The final grade in the course will be determined as follows:

- Assignments — 40% (≤ 2 Per Group)
  - Intro C++ / SFML / AI (Programming)
  - Movement in Games (Programming)
  - PCG (Programming)
  - Project Setup (Programming)
- Quizzes (D2L Quiz) — 10% (Solo)
- Project / Presentation — 50% (≤ 2 Per Group)
  - Project Proposal (Written)
  - Project Demo
  - Full Project Code (Programming)
  - Presentation (Recorded Video)

**Note**: Due the online group work nature of this course, to show that you have individually learned the material, you must pass the final project to pass the course. If your grade on the final exam is less than 50%, then your overall course grade will be equal to the mark that you received on the project. If your project grade is greater than or equal to 50%, your course grade is determined by the scheme above.

**Academic Misconduct:**

I take academic misconduct very seriously, especially for remotely delivered courses. Anyone found cheating in this course will received the harshest possible academic penalties. Academic misconduct for this course includes (but is not limited to) the following:

- Handing in any material for evaluation that was done outside you /your group
- Obtaining solutions from ANY non-class source, such anyone outside of your group, previous course offerings, stack overflow, etc (unless specifically stated otherwise)
- Sharing assignment or exam questions outside of the course for any reason, including assignment sharing websites or online repos such as GitHub
- Reverse engineering any obfuscated solution code that may be given to you

**COVID Notice:**

All lecture delivery and evaluation for this course will be done remotely / online for the entire term, no matter whether MUN returns to in-person classes or not. Since lectures are being delivered remotely, they will not be affected by any COVID related issues that may arise.

**Memorial University Policies:**

Memorial University of Newfoundland is committed to supporting inclusive education based on the principles of equity, accessibility, and collaboration. Accommodations are provided within the scope of the University Policies for the Accommodations for Students with Disabilities (www.mun.ca/policy/site/policy.php?id=239). Students who may need an academic accommodation are asked to initiate the request with the Glenn Roy Blundon Centre at the earliest opportunity (www.mun.ca/blundon).

Students are expected to adhere to those principles which constitute proper academic conduct. A student has the responsibility to know which actions, as described under Academic Offences in the University Regulations, could be construed as dishonest or improper. Students found guilty of an academic offence may be subject to a number of penalties commensurate with the offence including reprimand, reduction of grade, probation, suspension or expulsion from the University. For more information regarding this policy, students should refer to the University Regulations for Academic Misconduct (Section 6.12) in the University Calendar.