

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

**Computer Science 4303 – Winter 2021**  
**Artificial Intelligence for Computer Games**

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**Course Website:** <https://www.cs.mun.ca/~dchurchill/courses/4303>  
(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++17 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
- Decision Making (1 Assignment)
  - Finite State Machines
  - Behavior Trees
  - Utility Theory
  - Two-Player Search (Minimax / Alpha-Beta / MCTS)
- 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)
- 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  
(optional) CPP Reference

<http://a.co/d/2Ts1N4P>  
<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 50% (≤ 2 Per Group)
  - Intro C++ / SFML / AI (Programming)
  - Movement in Games (Programming)
  - Decision Making (Programming)
  - PCG (Programming)
- Project / Presentation 50% (≤ 2 Per Group)
  - Project Proposal (Written)
  - Project Setup Milestone (Programming)
  - 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.

**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](http://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](http://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.