MEMORIAL UNIVERSITY OF NEWFOUNDLAND
Department of Computer Science

Computer Science 3200
Algorithmic Techniques for Artificial Intelligence

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

Course Objectives:

This course is an introduction to Artificial Intelligence (AI), covering algorithmic techniques and data structures used in modern problem-solving environments. Each topic will have a related assignment where the learned techniques are applied to simple games.

Course Outline:

- Introduction to Artificial Intelligence
  - What is AI? What can Modern AI do?
  - Games as a Testing Environment for AI
  - Agents, Environments, and Problems
- Search Algorithms
  - Exhaustive Search (BFS / DFS)
  - Heuristic Functions / Incorporating Knowledge
  - Heuristic Search (Best-First Search / A*)
  - Introduction to Game Theory / Nash Equilibrium
  - Adversarial Search (Minimax / Alpha-Beta)
  - Data Structures / Optimizations for Search
- Genetic Algorithms (GA)
  - Introduction to Evolutionary Algorithms
  - GA Representations: (Genotype, Phenotype)
  - GA Implementation: Mutation, Crossover, Selection, Reproduction
- Reinforcement Learning (RL)
  - Introduction to RL: Agent, Environment, Actions, Policies, Rewards
  - Bandit Problems (Exploration vs. Exploitation)
  - Markov Decision Processes
  - Generalized Policy Iteration
  - Monte-Carlo Methods
  - Temporal Difference Learning (SARSA / Q-Learning)
- Neural Networks (NN)
  - Artificial Neurons / NN Structure / Training
  - Brief Introduction to Deep Learning

Textbook: Artificial Intelligence: A Modern Approach (Optional)
Russel & Norvig

Reinforcement Learning: An Introduction (Free Online)
Sutton & Barto
http://incompleteideas.net/book/the-book.html

Format: 2 lectures per week on Tuesday / Thursday (80 minutes each)
Lectures will be delivered remotely / recordings made available
Midterm and Final exams will be taken in-person on MUN campus (room TBA)

Evaluation:

The evaluation structure of the course is as follows:

• Assignments		50% (≤ 2 Per Group)
○ Intro to JS + BFS/ DFS	(Programming)	
○ A* Search Pathfinding	(Programming)	
○ Minimax + Alpha-Beta	(Programming)	
○ Genetic Algorithm	(Programming)	
○ Reinforcement Learning	(Programming)	
• Midterm Exam	(Written)	20% (Solo)
• Final Exam	(Written)	30% (Solo)

Note: Due the group work nature of this course, to effectively show that you have individually learned the material, you must pass the final exam 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 final exam. If your final exam grade is greater than or equal to 50%, your course grade is determined by the scheme above. Please do not be scared by this, no student (yet) has ever failed the final exam who was already passing the course.

COVID Notice:

The Midterm and Final exams for this course will be held in-person on campus. If any COVID-related issues arise during the term which requires MUN to close campus to students, the exams in this course will be moved online. Since lectures are being delivered remotely, they will not be affected by any COVID related issues that may arise.

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

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.