THE UNIVERSITY OF WINNIPEG

APPLIED COMPUTER SCIENCE

Course Number - GACS-7401-001
Course Name – Current Topics in Computing (Complex Adaptive Systems)

Instructor Information
Instructor: Sergio G. Camorlinga   **Office:** 3D29
E-mail: s.camorlinga@uwinnipeg.ca
Instructor's home page: https://acs.uwinnipeg.ca/scamorlinga

Office Hours: Thursdays   4:00-5:00 pm   Rm 3D29

Class meeting time: Tuesdays/Thursdays   10:00-11:15 am   Rm 3D03
Course Web Page: https://nexus.uwinnipeg.ca/d2l/home/54955

Important Dates
First Class: Sept 5, 2023
Reading Week (no classes)   Oct 8 – 14, 2023
Final Withdrawal Date w/o academic penalty: Nov 13, 2023
(A minimum of 20% of the work on which the final grade is based will be evaluated and available to the student before the voluntary withdrawal date)
Last Class: Nov 30, 2023
The University closures: Truth and Reconciliation Day   Sept 30, 2023
                           Thanksgiving   Oct 9, 2023
                           Remembrance Day   Nov 11, 2023

Course Objectives/Learning Outcomes
This course is an introduction to selected topics in the field of Complex Adaptive Systems (CAS) and its application to health and social systems. CAS are systems with many members, which are interacting, adapting and learning among themselves and the environment where they exist in a variety of ways. Because of these activities, novel properties for the system can emerge. Samples of CAS are everywhere and diverse, for instance our brains, immune systems, insect colonies, ecosystems, communities, geopolitical organizations, social systems, internet, etc. We will go over fundamental topics of complexity, cellular automata, dynamical systems, network models, genetic algorithms, immune systems, and artificial life. Then we will apply these ideas to health and social systems. We will utilize computational tools (Python & NetLogo models) to measure, simulate and analyze complexity in a variety of CAS. Theory and simulations will provide us some level of understanding for CAS and a methodology to better manage CAS and their interrelationships.

Evaluation Criteria

- Assignments: 30%
    - There will be 3 assignments worth 10% each.
        - May include theory, programming and/or analysis exercises
    - Due at the beginning of class on due dates.
    - No late assignment will be accepted, or under special circumstances accepted with 20% off for each late day.
    - Assignments should be submitted in pdf format by due date and medium (e.g. Nexus, email, printed, etc.) as specified in the assignment description. Handwritten assignments will not be accepted.
    - Multiple submissions are not permitted. Students may submit a partially completed assignment though.
    - If submitting assignments, students are responsible to review their assignments before submission to make sure the correct files are attached to the submission.

- Paper Presentations: 30%
    - There will be 4 paper presentations per student
    - Each presentation is worth 7.5% each
    - PowerPoint slides should be used for the presentation
    - PowerPoint slides should be submitted one day before presentation day by email.
    - Attendance and participation are required for all.
    - No attendance to a presentation without justification will deduct 2% per no show-up attendance

- Final Project: 40%

Final Letter Grade Assignment

Historically, numerical percentages have been converted to letter grades using the following scale. However, instructors can deviate from these values based on pedagogical nuances of a particular class, and final grades are subject to approval by the Department Review Committee.

A+	90+ - 100%	B+	75 - 79%	C	60 - 64%
A	85 - 90%	B	70 - 74%	D	50 - 59%
A-	80 - 84%	C+	65 - 69%	F	below 50%

Prerequisite and Restriction Information[*]
(This information can be found in the UW Graduate Academic Calendar)
- Consent of the Graduate Studies Committee Chair or Instructor.

Services for Students
Students with documented disabilities, temporary or chronic medical conditions, requiring academic accommodations for tests/exams (e.g., private space) or during lectures/laboratories (e.g., note-takers) are encouraged to contact Accessibility Services (AS) at 786-9771, accessibilityservices@uwinnipeg.ca or https://www.uwinnipeg.ca/accessibility-services/ to discuss appropriate options. All information about a student's disability or medical condition remains confidential.

Students may choose not to attend classes or write examinations on holy days of their religion, but they must notify their instructors at least two weeks in advance. Instructors will then provide opportunity for students to make up work or examinations without penalty. A list of religious holidays can be found in the Undergraduate Academic Calendar at https://www.uwinnipeg.ca/academics/calendar/docs/important-notes.pdf

Regulations, Policies, and Academic Integrity
Students are encouraged to familiarize themselves with the Academic Regulations and Policies found in the University Academic Calendar at:
https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf
Particular attention should be given to subsections 8 (Student Discipline), 9 (Senate Appeals) and 10 (Grade Appeals).

Avoiding Academic Misconduct: Academic dishonesty is a very serious offense and will be dealt in accordance with the University's policies.

Detailed information can be found at the following:

- Academic Misconduct Policy and Procedures: https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-policy.pdf and https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-procedures.pdf
- About Academic Integrity and Misconduct, Resources and FAQs: https://library.uwinnipeg.ca/use-the-library/help-with-research/academic-integrity.html

Uploading essays and other assignments to essay vendor or trader sites (filesharing sites that are known providers of essays for use by others who submit them to instructors as their own work) involves "aiding and abetting" plagiarism. Students who do this can be charged with Academic Misconduct.

Academic Integrity and AI Text-generating Tools: Students must follow principles of academic integrity (e.g., honesty, respect, fairness, and responsibility) in their use of material obtained through AI text-generating tools (e.g., ChatGPT, Bing, Notion AI). If an instructor prohibits the use of AI tools in a course, students may face an allegation of academic misconduct if using them to do assignments. If AI tools are permitted, students must cite them. According to the MLA (https://style.mla.org/citing-generative-ai/), writers should

- cite a generative AI tool whenever you paraphrase, quote, or incorporate into your own work any content (whether text, image, data, code or other) that was created by it
- acknowledge all functional uses of the tool (like editing your prose or translating words) in a note, your text, or another suitable location
- take care to vet the secondary sources it cites

If students are not sure whether or not they can use AI tools, they should ask their professors.

Non-academic misconduct: Students are expected to conduct themselves in a respectful manner on campus and in the learning environment irrespective of platform being used. Behaviour, communication, or acts that are inconsistent with a number of UW policies could be considered "non-academic" misconduct. More detailed information can be found here:

- Respectful Working and Learning Environment Policy https://www.uwinnipeg.ca/respect/respect-policy.html,
- Acceptable Use of Information Technology Policy https://www.uwinnipeg.ca/institutional-analysis/docs/policies/acceptable-use-of-information-technology-policy.pdf
- Non-Academic Misconduct Policy and Procedures: https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-policy.pdf and https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-procedures.pdf.

Copyright and Intellectual Property: Course materials are the property of the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides—irrespective of format. Students who upload these materials to filesharing sites, or in any other way share these materials with others outside the class without prior permission of the instructor/presenter, are in violation of copyright law and University policy. Students must also seek prior permission of the instructor/presenter before, for example, photographing, recording, or taking screenshots of slides, presentations, lectures, and notes on the board. Students found to be in violation of an instructor's intellectual property rights could face serious consequences pursuant to the Academic Misconduct or Non-Academic Misconduct Policy; such consequences could possibly involve legal sanction under the Copyright Policy: https://copyright.uwinnipeg.ca/basics/copyright-policy.html

Privacy

Students have rights in relation of the collecting of personal data the University of Winnipeg
- Student Privacy: https://www.uwinnipeg.ca/privacy/admissions-privacy-notice.html
- Zoom Privacy: https://www.uwinnipeg.ca/privacy/zoom-privacy-notice.html

Class Cancellation, Correspondence with Students and Withdrawing from Course

When it is necessary to cancel a class due to exceptional circumstances, the course instructor will make every effort to inform students via uwinnipeg email account and Nexus.

Students are reminded that they have a responsibility to regularly check their uwinnipeg e-mail addresses to ensure timely receipt of correspondence from the University and/or the course instructor.

Please let course instructor know if you plan on withdrawing from the course. Note that withdrawing before the VW date does not necessarily result in a fee refund.

Text Book(s) / Reading List / Tools

We will use the following books as guides, supplemented with readings and other books throughout the course.

- Complexity: A Guided Tour
  Mitchell, Melanie
  Oxford University Press, 2009 Edition
  ISBN 978-0-19-512441-5

- Complex Adaptive Systems: An Introduction to Computational Models of Social Life
  Miller John H. & Page Scott E.
  Princeton University Press, 2007 Edition
  ISBN 978-0-691-13096-5 (acid-free paper) / 978-0-691-12702-6 (pbk: acid-free paper)

- Introduction to the Modeling and Analysis of Complex Systems
  Hiroki, Sayama
  Open Suny Textbooks, 2015 Edition
  ISBN 978-1-942341-08-6 (paper) / 978-1-942341-09-3 (ebook)

- Natural Complexity, a Modeling Handbook
  Charbonneau, Paul
  Princeton University Press, 2017 Edition
  ISBN 978-0-691-17684-0 (paper) / 978-0-691-17035-0 (pbk.)

Topics to be covered (Tentative)

I. CAS Introduction
- Modeling introduction
- Complexity, emergence, self-organization
- Dynamics, chaos and prediction, fractals
- Information, computation, and evolution

II. Fundamental Concepts
- Modeling
- Agent-based objects
- Genetic algorithms
- Cellular automata
- Network models
- Dimensionality and scaling

III. Selected CAS Topics
- Artificial life
- Computational immunology
- CAS in health systems
- CAS in social systems
- Open agenda for future works

Note that all topics listed may not be covered and may be offered in a slightly different time order. Computer models based on Python and NetLogo will be heavily used during the course

Additional Course Related Information

1. The following two classes will be recorded (i.e. no in-person class) and made available VOD in Nexus
- Tuesday October 24, 2023
- Thursday October 26, 2023

Note: A permitted or necessary change in mode of delivery may require adjustments to important aspects of course outlines, like class schedule and the number, nature, and weighting of assignments and/or exams.

2. Course Planning Sheet

Course Week	Lecture Date	Activity Handed out	Activity Due	Note
One	05-Sep	Presentation Instructions Presentation Feedback	-	First class
-	07-Sep	-	-	
Two	12-Sep	-	-	-
-	14-Sep	-	-	-
Three	19-Sep	Assignment #1	-	-
-	21-Sep	-	-	-
Four	26-Sep	-	-	-
-	28-Sep	-	-	-
Five	03-Oct	-		-
-	05-Oct	-		-
Six	10-Oct	Assignment #2	Assignment #1	Reading week
-	12-Oct	-	-	Reading week
Seven	17-Oct	-	-	-
-	19-Oct	Final Project Description Report Template	-	-
Eight	24-Oct		-	VOD class
-	26-Oct	-	-	VOD class
Nine	31-Oct	Assignment #3	Assignment #2	-
-	02-Nov	-	-	-
Ten	07-Nov		-	-
-	09-Nov	-	-	-
Eleven	14-Nov		-	-
	16-Nov	-	-	-
Twelve	21-Nov	-	Assignment #3	-
-	23-Nov	-	-	-
Thirteen	28-Nov	-	-	-
-	30-Nov	-	-	Last class
Fourteen	06-Dec	-	Final Project Package @ noon	-
-	08-Dec	-	30-min Project Demos	-