



Department of Computer Science
Faculty of Mathematics and Science

COSC 4P82 Genetic Programming

Winter 2024

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Lectures: Monday, Thursday 8:00-9:30am, Academic South 216
WWW: <http://www.cosc.brocku.ca/Offerings/5P71/>
Brightspace: <https://brightspace.brocku.ca/d2l/home/77513>

4P82 Prerequisites: COSC 3P71 (min 60%) or permission of instructor.

4P82 TA: TBA

Description: The course introduces the field of genetic programming (GP), which is a computational intelligence technique for automatic program development. Topics to be covered include:

- Tree-based genetic programming
- Alternate tree representations: strong typing, grammar-guided
- Alternate GP representations: linear GP
- Theoretical limitations: No Free Lunch Theorem, computational complexity
- Parallelism: Island-model, GPU
- Applications: symbolic regression, optimization, intelligent agents, classification, computer vision, art and design, music,...

I will present fundamental topics during lectures.

Text: *A Field Guide to Genetic Programming* by R. Poli, W.B. Langdon, N. F. McPhee. ISBN 978-1-4092-0073-4. 2008.

- Download free PDF here: <http://www.gp-field-guide.org.uk/>
- Other recommended reading will be mentioned in class, available in the library, and listed on the web site.

Course Communications: Email communications will be sent to the course mailing list. Be sure to regularly check your Brock email for course news. See the course web site for further information.

Evaluation:

- Assignments (2): 30%
- Project: 35%
- Term Test: 15%
- Seminar: 15%
- Seminar participation: 5%

Assignments: Assignments will involve applying GP to solve specific application problems. Typically, you will use an existing GP system downloaded from the web. The most popular choices are ECJ (Java-based) and DEAP (Python). The TA will present a tutorial at the start of the course on getting ECJ and DEAP to compile and execute. You are welcome to use any other GP system you like. Others used include Open Beagle (C++), RobGP (C++, written by a Brock student named Rob), and many others.

Assignments can be done individually or in groups of 2. Those in groups must contribute equally to all aspects of the assignment. Assignments will require submission of a written scientific report.

Late Submission Policy: No lates are accepted.

Seminars: The final weeks of the course will have student seminars, in which you will have the opportunity to research and present your own selected topics. The seminars are intended to give you experience in independent research, as well as presenting technical material to the class. Undergraduates will present seminars in groups of 3 (smaller if necessary). MSc students will present seminars in groups of 2 (individually if necessary). Group presentations must have each member contribute equally to the seminar. Your seminar can be in any suitable topic in genetic programming. A topic might be a research paper you discovered from a journal or proceedings, a section or chapter from a book, or information from a web site. You must run your topic idea by me beforehand to make sure it is appropriate. A schedule of seminar topics will be maintained online. A web page or PDF/Powerpoint file with the details of your seminar will be required. This will be made available to the class. Details about seminars (dates, durations, topics) will be discussed later. Seminar attendance by all students is expected; details below.

Project: Please see the 4P82 project handout for details.

Relationship between attendance and grades: As is usually the case in university courses, attendance in class correlates with a good grade in the course. If you must miss a lecture, you are expected to obtain the material and other information from the lecture from another student (not the professor).

The seminar participation grade is given for attending all the seminar dates (other than your own, of course). Attendance will be taken during the seminars.

Important dates: (check the [online University calendar](#) for makeup days due to holidays)

Last date to withdraw without academic penalty: March 8, 2024

Date you will be notified of 15% of your course grade: March 1, 2024

Academic Policies

Academic Integrity:

Academic misconduct is a serious offence. The principle of academic integrity, particularly of doing one's own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students should consult Section VII, "Academic Misconduct", in the "Academic Regulations and University Polices" entry in the Undergraduate Calendar, available at <http://brocku.ca/webcal> to view a fuller description of prohibited actions, and the procedures and penalties.

Penalties for academic can result in zero on the piece of work, failure in the course, and more severe penalties if a history of infractions has occurred in courses at Brock. If a group is found guilty of academic misconduct, both group members will be assigned the same penalty. It is the responsibility of both members to be aware of the source of the work, and be knowledgeable about all aspects of the submission (code, experiments, report).

All group members will be penalized when academic misconduct is determined. A group member will not be allowed to "take a bullet for the group".

Turnitin.com may be used on final project submissions. If you object to uploading your work to Turnitin.com for any reason, please notify me within the first 2 weeks of the term to discuss alternative submissions.

Moss (programming code plagiarism checker) or other code checking systems may be used on assignments and projects.

Assignments and projects are to be done individually or in pairs. You are not permitted to collaborate or share code or algorithms; use and/or modify code created by others (other than the main GP system you use); use programs submitted for credit in other courses; copy and/or modify code found online, even if it is advertised as open source code; hire or pay for contracted solutions to your work, including the authoring of the assignment/project report. Note that citing source code means it may not be plagiarized; however, you may not receive marks for the assignment or project, since it is not your own work.

If you find libraries that help with your assignment or project, please ask me before using them. Some libraries may not be permitted, especially if they perform the majority of the content of an assignment or project. You must cite the sources of all libraries and ideas used in your work.

AI and LLMs:

LLMs such as ChatGPT and others should not be used to implement your assignments, projects, and seminar presentations. These systems do generate code, which is often correct. However, the code is often incorrect and/or inefficient. It has the ability to make programmers dumber. It may also be very difficult to determine its correctness in a genetic programming application, because evolution will always generate something as a solution. If that solution is bad or incorrect, finding out the reason is not trivial, especially when you are unfamiliar with the code used by the GP system (GP language implementation, training data I/O, fitness evaluation,...). **You should strive to be smarter than AI when you use or implement AI technology. Society's future depends on it!**

Academic Accommodation Statement:

As part of Brock University's commitment to a respectful work and learning environment, the University will make every reasonable effort to accommodate all members of the university community with disabilities. If you require academic accommodations related to a documented disability to participate in this course, you are encouraged to contact Svices for Students with Disabilities in the Student

Development Centre (4th floor Schmon Tower, ex. 3240). You are also encouraged to discuss any accommodations with the instructor well in advance of due dates and scheduled assessments.

Academic Accommodation due to Religious Obligations:

Brock University acknowledges the pluralistic nature of the undergraduate and graduate communities such that accommodations will be made for students who, by reason of religious obligation, must miss an examination, test, assignment deadline, laboratory or other compulsory academic event. Students requesting academic accommodation on the basis of religious obligation should make a formal, written request to their instructor(s) for alternative dates and/or means of satisfying requirements within the first 2 weeks of the course.

Medical Exemption Policy:

The university's medical forms are found here:

<https://brocku.ca/health-wellness-accessibility/student-health-services/faq-health-services/#1605198027214-fd26bca7-b65e>

Note that medical accommodation applies to an individual student, and not groups who are working together on assignments and projects.