CIS 421 Artificial Intelligence
Fall 2019

Professor: Dr. Laura Grabowski
Office: Dunn 303
Office Hours: MWF 11:00 AM – 12:30; TR 11:00 AM – 12:00 PM; *and by appointment.*[1]
Voice: (315) 267-2216
E-mail: grabowlm@potsdam.edu
CS Department Slack Workspace: https://join.slack.com/t/potsdamcsdepartment/signup
Join with your Potsdam email address. If you're already on Slack with another email, you can link multiple emails with no problem. A Slack message is **THE BEST** way to get a question answered by me evenings/weekends!

Course Topics:

- *Catalog description:* Knowledge representation, searching and heuristics. Game and goal trees; graphs. Applications to game playing, theorem proving, pattern recognition and natural language processing. Prerequisite: CIS 303.
- *My description:* The course will provide an application-centered view of selected classical and current approaches to artificial intelligence, such as search, optimization methods, neural networks, and machine learning. We will also explore selected societal, ethical, and philosophical issues related to artificial intelligence.

Prerequisites: The official prerequisite for the course are listed in the catalog description, above. The programming in the course is challenging, and the prerequisite is strictly enforced.

Course Objectives: The purpose of this course is to provide the student with an understanding of traditional and current artificial intelligence approaches and research areas.

Learning Objectives: The Computer Science department has adopted ten learning objectives for students completing an undergraduate major or minor in the department. These learning objectives map to the undergraduate computer science curricula outlined by the Association for Computing Machinery (ACM) and the Computing Accreditation Commission (CAC) of the Accreditation Board for Engineering and Technology (ABET). Each course in the curriculum is designed to address particular objectives so that the overall curriculum fulfills our goal of producing capable computer scientists. The objectives (and broad outcomes) serve as a rubric for evaluating the learning that happens in this class. You may wish to review this section of the syllabus when filling out the course evaluation and especially when studying for midterm and final exams.

Students in the Computer Science program at SUNY Potsdam are expected to graduate with a:

1. **Knowledge of discrete and continuous mathematics --- including elementary probability and statistics – and the ability to apply logic and mathematical proof techniques to computing problems.** After this course, students will be able to:
    a. Apply knowledge of probability and statistics to solving AI problems.
    b. Implement principles of randomness in the context of AI methods.
    c. Analyze and report on experimental results using appropriate statistical methods.
2. Knowledge of basic theory of computability and complexity of computation. *Not emphasized in CIS 421.*
3. **Knowledge of and the ability to apply programming fundamentals in at least two programming languages.** After this course, students will be able to:
    a. Design and implement substantial AI programs to solve given problems using specified methods.
    b. Implement AI algorithms and methods that are evaluated based on correctness, completeness, design, good coding practice, and performance.
4. **Knowledge of fundamental data structures and algorithms --- including analysis of their correctness and complexity --- related to various fields of computer science, and the ability to apply this knowledge to problems through the use of appropriate programming languages.** After this course, students will be able to:
    a. Make informed decisions regarding data structures and algorithms used in implementation.
    b. Apply knowledge of program efficiency to the design of their implementations.
5. Knowledge of computer architecture and organization, computer operating systems, and computer

[1] I usually maintain an open-door policy, If my office door is open, you're welcome to stop in with questions, even if it's not during official office hours. If the door is closed, I am busy and cannot see students at that time.

networks, and the ability to apply this knowledge to problems through the use of appropriate programming languages. *Not emphasized in CIS 421.*

6. Competence and effectiveness in technical oral, written, and visual communication, particularly as they apply to the dissemination of technical information on subjects dealing with computing technology and applications. *Not emphasized in CIS 421.*
7. Knowledge of and skill in applying good practices in software engineering. *Not emphasized in CIS 421.*
8. The ability to function effectively in teams to accomplish a common goal. *Not emphasized in CIS 421.*
9. **An understanding of professional, ethical, legal, security, and social responsibilities and issues, including an awareness of impact of computing on individuals, organizations, and society.** After this course, students will be able to:
   a. Discuss AI technology-related policy questions that are in the news.
   b. Analyze the ethical/moral positions underpinning positions in a policy issue.
   c. Make design decisions within an ethical framework.
10. A commitment to continuing professional development. *Not emphasized in CIS 421.*

General Class Information

- **Class Time/Place:** MWF 10:00 AM – 10:50 AM, Dunn 102
- **Required Text:**
  - Jones, M. Tim. (2005). *AI Application Programming,* 2nd edition. Boston: Course Technology. ISBN 10: 1-58450-421-8; ISBN-13: 978-1-58450-421-4.
  - I will be lecturing primarily from this textbook. The book is out of print (and a bit old), and there is not a new edition. I have made portions of the book available in PDF form through Moodle.
  - I will assign additional readings beyond the textbook. I will make as much a possible available through Moodle.
- **Exam Dates/Time** (tentative) **and Other Important Dates**
  - Midterms:
    - Midterm 1: Friday October 4
    - Midterm 2: Friday November 1.
  - Comprehensive Final: Friday December 13, 10:15 AM – 12:15 PM. **NOTE:** I will NOT allow you to take the final at a different time except in exceptional circumstances and in accordance with university policy.
  - Other important dates
    - **Fall recess:** Friday Oct 11 (10 PM) – Tuesday Oct 15. Classes resume 8 AM on Wednesday Oct 16.
    - **Thanksgiving recess:** Tuesday Nov 26 (10 PM) – Sunday Dec 1. Classes resume at 8 AM on Monday Dec 2.
    - **Last day to withdraw or elect S/U:** Friday, Nov 1.
    - See the university website for additional calendar information, http://www.potsdam.edu/academics/calendar.

Course Requirements and Procedures

- **Distribution of your grade:** I will grade your course work using the following distribution:

Assignments	40%
Daily Question	10%
Midterm Exams (2)	25%
Final Exam	25%

  - **Assignments**. Assignments will consist primarily of programming assignments. There will be 6-8 assignments throughout the semester. Materials will be distributed, and assignments submitted through Moodle.
  - **Daily Question.** Each class meeting, you will bring a written question that you will hand in during the first 5 minutes of class. The question may be about anything relating to the course material, whether it's a question from the last class meeting or two, a question about the assigned reading, a clarification on an assignment, or something relevant that you saw/heard/read in the news. Class may include answering some of the daily questions. Daily questions will be turned in as hard copy and may be hand-written. Please be sure that your name is on your question. Grading of daily questions is binary – either you turn it in, or you don't. The daily question cannot be made up if missed, cannot be emailed, and I will accept them ONLY during the first 5 minutes of class.

- **Exams (Midterm*2, Final).** There will be 3 written exams, 2 midterms and a final. The final exam will be comprehensive/cumulative. See “Exam Dates/Time (tentative) and Other Important Dates,” above, for dates of exams.

- **Grading procedure:** Your course-grade average (on a scale of 0 – 100%) will be calculated as the weighted average of your averages on each area above using the weight distribution that is listed above. Final grades are determined according to the scale shown below, subject to a curve at the discretion of the professor.

  4.0: 95 – 100%
  3.7: 90 – 94%
  3.3: 85 – 89%
  3.0: 80 – 84%
  2.7: 77 – 79%
  2.3: 73 – 76%
  2.0: 70 – 72%
  1.7: 67 – 69%
  1.3: 63 – 66%
  1.0: 60 – 62%
  0.0: <60%

  NOTE: The actual scale used may be adjusted according to the performance of the class as a whole, again at the professor’s discretion. In borderline cases, attendance, class participation, and completion of assigned work will be used to make a decision on the course grade.
- **Extra Credit: No special arrangements will be made for extra credit for improving grades.** There may be some extra credit offered for participating in certain activities, to be announced if such activities arise.
- **Exam make-ups:** You must give me prior notice if you must miss an exam. No make-ups will be granted unless satisfactory documentation is produced to show an extenuating circumstance.
- **Late assignments:** I will follow the standard CS Department late policy of a 1-week late submission period accompanied by a 25% score penalty. There will be no exceptions, regardless of how late an assignment is. Please see “Assignment Submission Policy and Guidelines,” below, for more information.
- **Impact of extracurricular activities on class work:** You make the choices about how you will spend your time, including investing your time in non-academic activities. As a student, you need to give priority to your academic work, and prevent extracurricular commitments from negatively impacting your work for classes. You are, of course, free to participate in activities that are meaningful to you; however, do not expect me to give special consideration because of time management issues that arise from those activities. You should not be missing class because of extracurricular activities, nor should you allow yourself to fall behind on assignments. **NOTE: I will not give extensions that relate to participation in extracurricular activities, even if the activity is related to Computer Science.**
- **Grading questions:** If you have a question about a grade, you must (1) wait 24 hours after receiving the grade before contacting me, and (2) communicate with me within one week of the day the graded work is returned to you. You lose the right to re-grading after that time.
- **Incompletes:** Incomplete grades (Inc) are granted rarely. Incompletes are not to be used as a shelter from potentially low grades. An incomplete grade may be reported for you only when the following conditions are satisfied (SUNY Potsdam Undergraduate Catalog):
  1. The student has requested an incomplete.
  2. Course requirements have not been completed for reasons beyond the student's control. (e.g. illness or family emergency).
  3. The student has completed the majority of the work for the class, and the student can accomplish the remaining requirements without further registration.
- **Academic integrity:** You are expected follow the "SUNY Potsdam Academic Honor Code" (SUNY Potsdam Undergraduate Catalog) by doing your own work on all required work for the course unless specifically directed otherwise by the professor. **Copying is strictly forbidden**. Students caught cheating will receive a grade of 0 for that evaluation. More than one offense will result in dismissal from the course and possible disciplinary sanctions by the university. Academic Misconduct definitions, procedures, due process, and student rights are described in the SUNY Potsdam Undergraduate Catalog, as cited above. Please see additional information in “Assignment Submission Policy and Guidelines,” below.

- **Accommodative Services:** If you have special needs that must be accommodated to fulfill the course requirements, you must notify the professor and Sharon E. House, Director of Accommodative Services, 111 Sisson Hall, 267-3267. The university has resources available to assist qualified students with their academic studies. Please note that the professor is not able or qualified to determine what accommodations are necessary and appropriate. That task must be accomplished by the Accommodative Services staff. It is up to the student to initiate the process with Accommodative Services.
- **Food and Drink in Class and Lab:** Beverages are allowed in the lecture classroom as long you clean up after yourself and do not disturb others. Please do not bring food to lecture. UNDER -**NO**-CIRCUMSTANCES ARE FOOD AND BEVERAGES (EVEN GUM OR WATER BOTTLES) ALLOWED IN THE LAB!
- **Accommodation of Religious Observances:** I will make reasonable accommodation for a student's religious beliefs. Please notify me within the first week of classes about any scheduled class date that conflicts with a religious observance.
- **Course Withdrawal:** The last day to drop a semester course without receiving a grade is Friday, November 1.
- **Moodle Page:** All the information and content for the course will be distributed through the course Moodle page. I expect that you will check the page daily for updates and announcements. Announcements posted in the News Forum in Moodle will automatically be sent to your Potsdam email, so you must also check your email daily. If you have schedule questions, look in Moodle first, before you send me an email.

Computer Use

- You can do your programming assignments on the workstations in DUNN 302. **ALL assignments MUST compile and run on the Linux machines/server in the lab**. Be sure that you have tested your programs in the lab for compilation and correct behavior before submitting.
- You must use your SUNYCard to enter the Unix classroom (Dunn 302). Your computer account in the Unix classroom is your private property and should be treated as such. Please protect yourself by keeping your password private and making sure that you completely log out every time you use your account. ***NOTE: It is <u>your</u> responsibility to prevent others from plagiarizing your work.***

Assignment Submission Policy and Guidelines

- You will receive a new programming assignment approximately every two weeks. Assignments are individual. Assignments will be graded on correctness, quality, and style **Programming assignments must be written in Java and must compile from the command line**. Programs that do not follow commenting standards will not be graded and will receive a 0. As stated above, late assignments will be accepted for 1 week after the due date/time with a penalty of 25%. Extensions that are not subject to penalty may be granted in rare cases when there are extenuating circumstances (such as serious illness or disability, a death in the family, an accident, *etc*.) and when these circumstances are supported by written documentation. **Note: I will not give extensions because of involvement in outside activities such as attendance at hackathons, ACM activities, and the like** (see above, “Impact of extracurricular activities on class work”)**.** In general, I avoid giving individual extensions on assignments, since it seems unfair to the class as a whole. However, I will consider granting an extension on a case-by-case basis, if you come speak to me in person and make your case to my satisfaction. **Such requests should be made at least 24 hours before an assignment’s due date.**
- Every programming assignment that you submit **must** adhere to the published CS Department Coding Standards and have a header comment like the one shown below. **All files MUST include the header comment. Programs submitted with no comments will receive 0 points and no additional evaluation.**

```
/**
*   Gargoyle draws a random ASCII art monster on standard output.
*
*   Gargoyle has all static methods (and no constructor) including
*   main. It is run with a single integer on the command-line that
*   is used to randomize the monster that is generated.
*
*   @author Jimmy A. Student
*   @email studeja199@potsdam.edu
*   @course CIS 203 Computer Science II
*   @assignment 4
*   @due 04/25/2018
*/
```

- You will submit your source code program files electronically through the Moodle assignment. Assignments submitted through any other channel (including email) will NOT be accepted. If you claim issues with Moodle, I will check with the university's Moodle team to verify that you were logged in and attempted assignment submission. Work that is not submitted through Moodle cannot be graded and will receive a grade of zero.
- **All assignments will be due at the start of class time.** Late submissions are determined by the Moodle submission time stamp. Be advised that you must account for time differences between the Moodle server and your local machine as well as network latency. The Moodle time stamp is the final word on submission status. I will not allow you to submit work if the Moodle assignment has closed, unless I made an error in configuring the assignment.
- Programming assignments must reflect your ability to program. Acceptable discussion and help from other students include behaviors such as the following:
    - Talking to others in the class about assignments to discuss approaches to solving programming problems.
    - Looking at someone else's code to help find and point out a silly syntactic error.
    - Discussing a programming concept, in general, (for example, if statements) if it appears that a fellow student does not understand that concept.

  However, there must be no collaboration on assignments above and beyond this. Specifically,
    - You must not be sharing any of your code with anyone else.
    - You must not be accepting any code from anyone else or copying and pasting code that you find online.
    - Two or more students must not be writing code together so as to essentially produce the same program, except within the assignment parameters described specifically for this course.
    - If a tutor is assisting you, that tutor must not be making any suggestions about your code except for general strategies for solving the problem, explaining general programming concepts, or catching simple, syntactic errors as described above.
    - You must not copy code that you find online, with or without changing that code. If we suspect that students and/or tutors are engaging in unfair collaboration as described above, we reserve the right to initiate a code review. In general, a code review includes examination of the code by the instructor, additional Computer Science faculty members, and anti-plagiarism software. If the code review reveals that code belonging to several students arose from a single source, or that one or more persons is involved in providing or receiving unfair help, all parties involved will receive a zero on that assignment. Any further problems in this regard with any student or tutor will be brought to the attention of the Dean of Students.
- If external documentation is required for an assignment, it must be word-processed or typeset. Handwritten documentation is not acceptable. Diagrams, of course, may be drawn by hand provided they are neat and legible.
- **Important notes on programs:**
    - Programs that do not compile on the CS lab server/workstations will receive a grade of 0.
    - Programs that are not properly commented, as described in the handouts, "CIS Coding Standards" and "Notes on Commenting Code" (in Moodle) will receive a grade of 0.

Expectations

- I am committed to quality teaching and to providing you a meaningful experience in this course. Learning is a highly collaborative effort, and you must do your part in order to receive the maximum benefit from the course. Essentially, I treat you as an adult, and expect adult behavior from you.
- For this class, **I expect you to**:
  - Attend each class, arriving on time and remaining throughout the entire class meeting. If you have a legitimate and important reason for needing to leave early, you must let me know before class starts.
  - Complete all assignments and submit them on time.
  - Interact respectfully with me, the course assistants, and your classmates.
  - Prepare for class by completing assigned reading before lecture.
  - Participate in class discussions and activities.
  - **Remain on task and focused during class (*i.e.,* no doing homework, engaging in side conversations, web-surfing, reading e-mail, going on Facebook/Twitter/Instagram/Tumblr/ or whatever the social media platform of the moment, chatting, IMing, texting *etc*. during class).** The brain research is in, and it says that you cannot effectively focus on working while doing Tumblr (or whatever) at the same time. Lack of attention during class demonstrates a lack of respect for your professor, fellow students, and the course.
  - Come speak to me IN PERSON and IMMEDIATELY at the **first** sign that you are having trouble with the class or if you miss assignments. If you wait or are "shy," there is little that I can do to help you. You must be your own advocate!
  - Take responsibility for your work and your performance in the course.
- **You may expect me to**:
  - Begin and end class on time.
  - Be prepared for class and use time as efficiently as possible.
  - Adjust class activities, assignments, and schedules as needed.
  - Correct you if you are not on task during class, or if you leave class early.
  - Clearly describe assignment requirements and the criteria that will be used to evaluate the completed work.
  - Evaluate your work fairly and objectively, using established rubrics/criteria.
  - Maintain my scheduled office hours, except on occasion when I am ill or called to a meeting.
  - Notify you as soon as possible of changes in course schedule or requirements.
  - Provide out-of-class help as my time permits.
  - Respond to your questions (in class, through e-mail, *etc.*) at the earliest possible appropriate time. Please note that sometimes this will necessitate that I delay answering a question until a more appropriate moment in class. Please allow 24 hours for me to respond to emails during the work week.

Professional Conduct

All members of the Potsdam Computer Science community are governed by the ACM Code of Ethics and Professional Conduct, https://www.acm.org/about-acm/acm-code-of-ethics-and-professional-conduct, which we have distilled into our SUNY Potsdam Department of Computer Science Code of Professional Conduct (see below). The department faculty are committed to modeling and promoting ethical and professional behavior for all our students.

SUNY Potsdam Department of Computer Science Code of Professional Conduct

1. **Preamble**
   All members of the ACM, including the Computer Science faculty of SUNY Potsdam, are committed to ethical professional conduct as specified in the ACM Code of Ethics and Professional Conduct. Students, taking courses from the faculty, are bound by our commitment.

   All members of the Department are obliged to remind one another to behave professionally. Violations should be reported promptly; however, capricious or malicious reporting of violations is, itself, a violation. When reporting, bring all relevant aspects of the incident to the faculty's attention.

2. **Moral Imperatives**
   As a Computer Science student I will...

   2.1. Respect all members of the Department.

2.1.1. Be professional in face-to-face and electronic interactions.

2.1.2. Be fair so everyone is free to work and learn.

2.1.3. Be active in preventing discrimination in physical and electronic spaces frequented by Department members.

2.2. Accept and provide appropriate feedback.

2.2.1. Avoid starting or spreading rumors.

2.2.2. Respect confidentiality.

2.3. Be honest, trustworthy, and respect intellectual property.

2.3.1. Only take credit for my own work.

2.3.2. Respect the privacy of others.

2.3.3. Access computing resources only when authorized and report any access risks discovered.

2.4. Contribute to society and human well-being.

2.4.1. Improve public understanding of computing and its consequences.

2.4.2. Consider both the direct and indirect impacts of my actions.

Student Support

Professor's Note: The Provost has requested that the following information be included in course syllabi. The following information is presented without modification.

Every student in this class is a valued individual. If you are struggling with issues outside of the classroom, please know that there are professionals both on and off campus who can assist you. If you need immediate assistance, please contact our campus Counseling Center (with free counseling) at (315) 267-2330 or visit their website. Links to other resources are provided below:

- Stacey L. Basford -- Title IX Coordinator
  - Van Housen Extension 392
  - (315) 267-2516
  - basforsl@potsdam.edu
  - http://www.potsdam.edu/offices/hr/titleix

- Bias Incident Reporting
  - http://www.potsdam.edu/about/diversity/biasincident

- Center for Diversity
  - 223 Sisson Hall
  - (315) 267-2184
  - http://www.potsdam.edu/studentlife/diversity

- University Police
  - Van Housen Extension
  - (315) 267-2222 (number for non-emergencies; for an emergency please dial 911)

- Student Conduct and Community Standards
  - 208 Barrington Student Union
  - http://www.potsdam.edu/studentlife/studentconduct/codeofconduct

- Reachout (24-hour crisis hotline)
  - (315) 265-2422

- Renewal House (for victims of domestic violence)

- SUNY Potsdam Campus Office: Van Housen Extension 390 (open Wednesdays, 9-5:00)
- (315) 379-9845 (24-hour crisis hotline)
- Email: renewalhouse@verizon.net

And please: if you see something, say something. If you see that someone that you care about is struggling, please encourage them to seek help. If they are unwilling to do so, Care Enough to Call has guidelines on whom to contact. Everyone has the responsibility of creating a college climate of compassion.

CIS 421 Tentative Schedule:

Week starting	Week	Topics	Reading**	Assignment Due
Aug 26	1	History of AI; AI Today Probability and randomness in AI	Ch. 1, 17 and TBD	
Sep 2	2	Fundamentals of Agents Simulated Annealing	Russell & Norvig, Ch. 2; Jones Ch. 3	
Sep 9	3	Concepts of Evolution Genetic Algorithms and Evolutionary Computation	Avida-ED Lab Manual Ch. 10	Assignment 1: Vacuum World (Fri Sep 13)
Sep 16	4	Genetic Algorithms and Evolutionary Computation	TBD	
Sep 23	5	Particle Swarm Optimization Artificial Life	Ch. 4 and TBD	Assignment 2: Genetic Algorithm (Fri Sep 27)
Sep 30	6	Pathfinding and A* **Midterm 1 (Fri Oct 4)**	Ch. 2 Midterm will cover weeks 1-5	
Oct 7	7	Ant Algorithms	Ch. 7	Assignment 3: Avida-ED (Fri Oct 11)
Oct 14	8	Intro. to Machine Learning ***Fall Recess: No classes Mon-Tue Oct 14-15 (classes resume Wed Oct 16, 8:00 AM)***	TBD	
Oct 21	9	Neural Networks	Ch. 8	Assignment 4: A* Search (Fri Oct 25)
Oct 28	10	Neural Networks **Midterm 2 (Fri Nov 1)** ***Last day to withdraw or elect S/U***	TBD Midterm will cover weeks 6-9	
Nov 4	11	Adaptive Resonance Theory Machine Learning and Discrimination	Ch. 5 and TBD	Assignment 5: Ant Colony Optimization (Fri Nov 8)
Nov 11	12	Reinforcement Learning	Ch. 9	
Nov 18	13	Reinforcement Learning, cont'd	TBD	Assignment 6: Neural Networks (Fri Nov 22)
Nov 25	14	Deep Learning ***Thanksgiving Recess: No classes Wed-Fri Nov 27-29 (classes resume Mon Dec 2, 8:00 AM)***	TBD	
Dec 2	15	Deep Learning, cont'd Final Exam Review (Fri. Dec. 6)	TBD	Assignment 7: Q-learning (Fri Dec 6)
Dec 9		**Final Exam (Comprehensive):** **Friday, December 13 10:15 AM – 12:15 PM, Dunn 102**		

** Some sections of the textbook will be skipped in lecture, and others omitted entirely. In addition, some topics are not covered by the textbook. I will provide lecture slides and additional resources for those topics. I may assign additional readings from other sources as appropriate.

See https://www.potsdam.edu/academics/calendar for important dates for Fall 2019.