Instructor: Dr. Alan Garvey
Office: VH 2166
Phone: x7600 (but please don’t leave voicemail)
E-Mail: agarvey@truman.edu (in general I will respond within 24 hours, often much more quickly, perhaps as much as 48 hour response times on weekends, sometimes.)
Website: Some course information is available on Blackboard. Many additional materials are available online at: http://vh216602.truman.edu/agarvey

Office Hours: MWF 7:30-8:30, 10:30-11:30am, Tu 9am-Noon

Please review important support instructions for online learners available at online.truman.edu. This site will provide you with the most up-to-date information on important University resources and where to access them.

WELCOME

I’m glad you are taking this course. I’m so glad that this course is back to in person instruction. I look forward to seeing you in class on a regular basis.

REQUIRED TEXTBOOK & OTHER RESOURCE INFORMATION

Required Reading Material (Books for Purchase)


Required Reading Material (Accessible Articles or Chapters Online – Not for Purchase)

Any additional readings for this class will be made available online at no charge.

Bookstore Website: https://www.bkstr.com/trumanstatestore/home

Truman Library Website: http://library.truman.edu/

PREREQUISITES, MINIMUM TECHNOLOGY, AND SKILL REQUIREMENTS

Prerequisites

Successful completion of CS 180 with a grade of C or higher. I will also accept CS 170 (C or higher) if you contact me.

Minimum Technology Requirements

To successfully participate in this course, you need:

- Reliable broadband internet connection (Cable modem, DSL, or satellite)
- Relatively new operating system so that you can get technical support if needed (Windows 7 or newer, Mac OSX, etc.)
- Internet browser compatible with Blackboard, such as Firefox or Chrome or Safari. See Blackboard’s help page for more details.
- Computer with speakers for listening to videos, microphone, and camera
Word processor (such as Microsoft Word or free software equivalent such as OpenOffice or LibreOffice). You can also work in Google Docs on the research project, but must download your work (checking the formatting) and submit as a .doc, .docx, or .pdf file. I cannot open documents in Mac’s Pages program, so if you use this be sure to save it as one of the previously listed file formats.

Minimum Technical Skills

To be successful in the course, you need to be able to:

- Access the internet and navigate websites using a web browser
- Use word processing to complete written assignments
- Navigate Blackboard and use it to submit assignments
- Be comfortable using Zoom for synchronous class work and office hours
- Be comfortable using your computer microphone, speakers, and video camera.
- Send and receive email, and check your email at least once daily.
- Access and use the library website (library.truman.edu), including searching for and downloading articles and book chapters on online databases
- Access and use ACM Digital Library (dl.acm.org), including searching for and downloading articles, books and conference proceedings
- Access the library and other online resources when off campus by using a VPN or view.truman.edu.
- Access the Truman software image or install a recent version of Python (including the Idle development environment) in your own computing environment. Prior programming experience is assumed, but it doesn’t necessarily have to be in Python.

Technical Expectations for Completing Assignments and Exams

To complete assignments you need to be able to navigate Blackboard and the class web site. Assignments will be made available through the class web site and submitted using the Assignment Submission form on the vh216602 server. If you have a problem submitting an assignment you should email me an attachment of your work, but this should only be used if the Assignment Submission form fails.

General Course Information

Introduction to the Course

Artificial Intelligence (AI) is a broad introduction to ideas about how to build intelligent artifacts using computer programs. We will study older symbolic computing approaches, such as search, minmax trees, decision trees, constraint satisfaction algorithms, and logic. We will also study more recent machine learning approaches, including neural networks and deep learning. You will explore these ideas in the Python programming language, as well as through traditional homework assignments. You will also be part of a team of 3 or 4 students who will develop their own significant software system that uses AI approaches from this course.

Course Description

Overview of some basic concepts of artificial intelligence. Designed to give insight into areas of active research and application. Programming in a language commonly used for artificial intelligence applications. Typical topics covered include expert systems, knowledge engineering, learning, natural language understanding, symbolic computation, automated reasoning, and neural networks.

Course Objectives
Learning Outcomes for Artificial Intelligence (organized by textbook chapters)

[ACM Curriculum Guideline Section, if applicable] [form of class assessment]

1 Introduction

Describe Turing test and the “Chinese Room” thought experiment. [Familiarity] [IS/Fundamental Issues]

Differentiate between the concepts of optimal reasoning/behavior and human-like reasoning/behavior. [Familiarity] [IS/Fundamental Issues]

Describe positive and negative ways in which computer technology (networks, mobile computing, cloud computing) alters modes of social interaction at the personal level. [Familiarity] [SP/Social Context]

Identify significant continuing trends in the history of the computing field. [Familiarity] [SP/History]

Identify the contributions of several pioneers in the computing field. [Familiarity] [SP/History]

2 Intelligent Agents

Determine the characteristics of a given problem that an intelligent system must solve. [Assessment] [IS/Fundamental Issues]

Compare and contrast the most common models used for structured knowledge representation, highlighting their strengths and weaknesses. [Assessment] [IS/Advanced Representation and Reasoning]

List the defining characteristics of an intelligent agent. [Familiarity] [IS/Agents]

Characterize and contrast the standard agent architectures. [Assessment] [IS/Agents]

3 Solving Problems by Searching

Describe various heuristic problem-solving methods. [Familiarity] [AL/Algorithmic Strategies]

Use a heuristic approach to solve an appropriate problem. [Usage] [AL/Algorithmic Strategies]

Describe the trade-offs between brute force and heuristic strategies. [Assessment] [AL/Algorithmic Strategies]

Use a greedy approach to solve an appropriate problem and determine if the greedy rule chosen leads to an optimal solution. [Assessment] [AL/Algorithmic Strategies]

Formulate an efficient problem space for a problem expressed in natural language (e.g., English) in terms of initial and goal states, and operators. [Usage] [IS/Basic Search Strategies]
Describe the role of heuristics and describe the trade-offs among completeness, optimality, time complexity, and space complexity. [Familiarity] [IS/Basic Search Strategies]

Describe the problem of combinatorial explosion of search space and its consequences. [Familiarity] [IS/Basic Search Strategies]

Select and implement an appropriate uninformed search algorithm for a problem, and characterize its time and space complexities. [Usage] [IS/Basic Search Strategies]

Select and implement an appropriate informed search algorithm for a problem by designing the necessary heuristic evaluation function. [Usage] [IS/Basic Search Strategies]

Evaluate whether a heuristic for a given problem is admissible/can guarantee optimal solution. [Assessment] [IS/Basic Search Strategies]

Design and implement A*/beam search to solve a problem. [Usage] [IS/Advanced Search]

Compare and contrast various heuristic searches vis-a-vis applicability to a given problem. [Assessment] [IS/Advanced Search]

4 Search in Complex Environments

Use recursive backtracking to solve a problem such as navigating a maze. [Usage] [AL/Algorithmic Strategies]

Design and implement a genetic algorithm solution to a problem. [Usage] [IS/Advanced Search]

5 Adversarial Search and Games

Calculate probabilities of events and expectations of random variables for elementary problems such as games of chance. [Usage] [DS/Discrete Probability]

Compare and contrast basic search issues with game playing issues. [Familiarity] [IS/Basic Search Strategies]

Apply minimax search with alpha-beta pruning to prune search space in a two-player game. [Usage] [IS/Advanced Search]

6 Constraint Satisfaction Problems

Formulate a problem specified in natural language (e.g., English) as a constraint satisfaction problem and implement it using a chronological backtracking algorithm or stochastic local search. [Usage] [IS/Basic Search Strategies]

7,8,9 Logical Agents, First-Order Logic and Inference in First-Order Logic

Convert logical statements from informal language to propositional and predicate logic expressions.
Apply formal methods of symbolic propositional and predicate logic, such as calculating validity of formulae and computing normal forms. [Usage] [DS/Basic Logic]

Use the rules of inference to construct proofs in propositional and predicate logic. [Usage] [DS/Basic Logic]

Describe how symbolic logic can be used to model real-life situations or applications, including those arising in computing contexts such as software analysis (e.g., program correctness), database queries, and algorithms. [Usage] [DS/Basic Logic]

Apply formal logic proofs and/or informal, but rigorous, logical reasoning to real problems, such as predicting the behavior of software or solving problems such as puzzles. [Usage] [DS/Basic Logic]

Describe the strengths and limitations of propositional and predicate logic. [Familiarity] [DS/Basic Logic]

Translate a natural language (e.g., English) sentence into predicate logic statement. [Usage] [IS/Basic Knowledge Representation and Reasoning]

Convert a logic statement into clause form. [Usage] [IS/Basic Knowledge Representation and Reasoning]

Apply resolution to a set of logic statements to answer a query. [Usage] [IS/Basic Knowledge Representation and Reasoning]

**11 Automated Planning**

Define the concept of a planning system and how it differs from classical search techniques. [Familiarity] [IS/Advanced Representation and Reasoning]

**12 Quantifying Uncertainty**

Calculate probabilities of events and expectations of random variables for elementary problems such as games of chance. [Usage] [DS/Discrete Probability]

Apply Bayes theorem to determine conditional probabilities in a problem. [Usage] [DS/Discrete Probability]

Make a probabilistic inference in a real-world problem using Bayes’ theorem to determine the probability of a hypothesis given evidence. [Usage] [IS/Basic Knowledge Representation and Reasoning]

Compare and contrast the basic techniques for representing uncertainty. [Assessment] [IS/Advanced Representation and Reasoning]

Apply Bayes’ rule to determine the probability of a hypothesis given evidence. [Usage] [IS/Reasoning Under Uncertainty]

Explain how conditional independence assertions allow for greater efficiency of probabilistic systems. [Assessment] [IS/Reasoning Under Uncertainty]
19, 21 Learning from Examples, Deep Learning

List the differences among the three main styles of learning: supervised, reinforcement, and unsupervised. [Familiarity] [IS/Basic Machine Learning]

Identify examples of classification tasks, including the available input features and output to be predicted. [Familiarity] [IS/Basic Machine Learning]

Explain the difference between inductive and deductive learning. [Familiarity] [IS/Basic Machine Learning]

Compare and contrast each of the following techniques, providing examples of when each strategy is superior: decision trees, neural networks, and belief networks. [Assessment] [IS/Advanced Machine Learning]

23 Natural Language Processing

Explain the role of an inverted index in locating a document in a collection. [Familiarity] [IM/Indexing]

Explain how stemming and stop words affect indexing. [Familiarity] [IM/Indexing]

Identify the challenges of representing meaning. [Familiarity] [IS/Natural Language Processing]

Identify techniques for information retrieval, language translation, and text classification. [Familiarity] [IS/Natural Language Processing]

27 Philosophy, Ethics, and Safety of AI

Describe Turing test and the “Chinese Room” thought experiment. [Familiarity] [IS/Fundamental Issues]

Describe positive and negative ways in which computer technology (networks, mobile computing, cloud computing) alters modes of social interaction at the personal level. [Familiarity] [SP/Social Context]
Availability of Course Content

Course content will be available on a combination of Blackboard and the class website (vh216602.truman.edu/agarvey).

Proctoring

Exams will be closed book and will be administered in our classroom, during class time and the standard final exam time.

Credit Hour Justification:

The minimum investment of time by the average Truman student necessary to achieve the learning goals in this course are not less than one hour (50 minutes) of classroom instruction and a minimum of two hours of out of class student work each week per credit hour awarded. This average time per week for an average student may have weekly variations.

IMPORTANT UNIVERSITY POLICIES AND PROCEDURES

Disability Services:

To obtain disability-related academic accommodations students with documented disabilities must contact the course instructor and the Office of Student Access and Disability Services (OSA) as soon as possible. Truman complies with ADA requirements. For additional information, refer to the Office of Student Access and Disability Services website at https://disabilityservices.truman.edu/. You may also contact OSA by phone at (660) 785-4478 or studentaccess@truman.edu.

Emergency Procedures:

In each classroom on campus, there is a poster of emergency procedures explaining best practices in the event of an active shooter/hostile intruder, fire, severe weather, bomb threat, power outage, and medical emergency. This poster is also available as a PDF at this link: http://police.truman.edu/files/2015/12/Emergency-Procedures.pdf. Students should be aware of the classroom environment and note the exits for the room and building. For more detailed information about emergency procedures, please consult the Emergency Guide for Academic Buildings, available at following link: http://police.truman.edu/emergency-procedures/academic-buildings/

This six-minute video provides some basic information on how to react in the event there is an active shooter in your location: http://police.truman.edu/emergency-procedures/active-shooter/active-shooter-preparedness-video/.

Truman students, faculty, and staff can sign up for the TruAlert emergency text messaging service via TruView. TruAlert sends a text message to all enrolled cell phones in the event of an emergency at the University. To register, sign in to TruView and click on the “Truman” tab. Click on the registration link in the lower right of the page under the “Update and View My Personal Information” channel on the “Update Emergency Text Messaging Information” link. During a campus emergency, information will also be posted on the TruAlert website http://trualert.truman.edu/.
Discrimination and Title IX:
Truman State University, in compliance with applicable laws and recognizing its deeper commitment to equity, diversity and inclusion, which enhances accessibility and promotes excellence in all aspects of the Truman Experience, does not discriminate on the basis of age, color, disability, national origin, race, religion, retaliation, sex (including pregnancy), sexual orientation, or protected veteran status in its programs and activities, including employment, admissions, and educational programs and activities. Faculty and staff are considered “mandated reporters” and therefore are required to report potential violations of the University’s Anti-Discrimination Policies to the Institutional Compliance Officer.

Title IX prohibits sex harassment, sexual assault, intimate partner violence, stalking and retaliation. Truman State University encourages individuals who believe they may have been impacted by sexual or gender-based discrimination to consult with the Title IX Coordinator who is available to speak in depth about the resources and options. Faculty and staff are considered “mandated reporters” and therefore are required to report potential incidents of sexual misconduct that they become aware of to the Title IX Coordinator.

For more information on discrimination or Title IX, or to file a complaint contact:

Ryan Nely, Institutional Compliance Officer, Title IX and Section 504 Coordinator
Office of Institutional Compliance
Violette Hall, Room 1308
100 E. Normal Ave
Kirkville, MO 63501
Phone: (660) 785-4354
titleix@truman.edu

The institution’s complaint procedure can be viewed at: http://titleix.truman.edu/files/2015/08/University-Complaint-Reporting-Resolution-Procedure.pdf and the complaint form is accessible at http://titleix.truman.edu/make-a-report/

IMPORTANT CONTACTS

Various offices that provide services to online students are identified at the One Stop Services page on online.truman.edu. Should you need to consult with administrators that oversee this department and course, here is the contact information for those individuals:

Computer Science Department Chair: Alan Garvey
Violette Hall 2166
785-7600
agarvey@truman.edu

Dean, School of Science and Mathematics: Dr. Tim Walston
Magruder Hall 2004
785-4248
samdean@truman.edu

Hopefully your experience with this class is positive. When and if you feel a complaint about this or another course is required, however, the procedure for lodging a complaint can be found on the University’s Report a Complaint page. Students taking an online course from outside of the state of Missouri should follow the complaint procedure offered here. Students are always asked to address their complaint to the professor of the course first when possible, then take their concerns to the Department Chair if the matter cannot be resolved with the faculty member.

LEARNER SUPPORT
The University provides a range of both academic and student support services to ensure your success. These offices can advise you on learning strategies, point you toward valuable services, and help you troubleshoot technical problems as they arise.

**Center for Academic Excellence**

The Center for Academic Excellence provides advising services for students in their first year for most departments, as well as tutoring services. The Center is located in Kirk Building 112 and it may be reached at 660-785-7403.

**Counseling Services**

Counseling Services are available on campus at McKinney Center. Appointments may be scheduled by calling (660) 785-4014. An after-hours crisis line is also available at 660-665-5621.

**IT Help Desk**

The IT Service Center has combined the IT Call Center, Help Desk and Telephone Services into a one-stop location to serve you. You will find the following services and more when you stop by Pickler Library 109 or call 660-785-4544. You may submit a customer support ticket at this web address.

**Writing Center**

I encourage you to use the University’s Writing Center for your writing projects. It is not a proofreading service. The writing consultants will read your work and give you feedback, letting you know what is working well (and why) and what might not be working so well (and why). They can help you understand and better your writing craft. They can also do brainstorming if you’re having a hard time getting started. And they have an online scheduler, so making an appointment is easy. The Writing Center is located in Kirk Building 120.

**IMPORTANT DATES**

For more information on drop and add dates and fees, see the registrar’s schedule.

**Start Date:** Tuesday, January 17, 2023  
**End Date of On-Campus Meetings:** Friday, May 12, 2023 (last day of Finals)  
**Last Day of the Full Semester:** Friday, May 5

**Drop Dates:**  
Last day to drop a course without a grade of “W” appearing on your transcript and no fee is January 23.  
Last day to drop a course without a grade of “W” appearing on your transcript but WITH a $50 fee is Friday, February 10.  
Last day to change to credit/no credit grading option is Friday, May 5.  
Last day to drop the class WITH a grade of “W” appearing on your transcript is Friday, May 5.

**Withdrawal Date:** May 5 is the last day to withdraw from ALL classes with no refund.

**DISCIPLINE-SPECIFIC INFORMATION**

Information on the Computer Science major can be accessed via the CS Department Website or the CS Catalog Description. This course counts toward the Area C elective in the Computer Science major or as an elective course in the Computer Science minor. This course is designated as Writing-Enhanced.

**ATTENDANCE/PARTICIPATION**

**University Policy**

The University-wide attendance policy can be viewed here.
Definition of Attendance for This Course

The General Catalog states:

The university expects students to attend all classes, yet recognizes co-curricular opportunities could lead to class absences. Faculty, students, and staff have the responsibility to support an environment that upholds the integrity of a Truman education and students’ ability to experience a diversity of educational experiences. Truman adheres to Federal law regarding accommodations. Absences related to disability accommodations will be handled in coordination with the Disability Services Office. Absences related to Title IX will be handled in coordination with the Institutional Compliance Office.

Students with sanctioned absences will not be penalized for being absent, but will be expected to make up any missed work within a reasonable length of time. The professor reserves the right to deem additional absences as unsanctioned once a student has missed 6.67% of class time for sanctioned absences. A list of sanctioned absences can be found in the General Catalog at [http://catalog.truman.edu/](http://catalog.truman.edu/). Sanctioned absences include serving as a representative of the University at intercollegiate athletic events, professional conferences, academic competitions, field trips for courses, interviews for graduate school or careers, health-related absences (with documentation), and absences covered by Truman’s non-discrimination policy. For an absence to be sanctioned, students must notify the professor of scheduled absences during the free add/drop period and as soon as possible for any other absences. Students should also provide the faculty member with written notification of the absence. Arrangements for making up prior work should be made prior to the absence. If the absence is unexpected, the student should arrange to make up the missed work as soon as possible. An appeal of a faculty member’s attendance policy can be made through the University Grade Appeals process (see the General Catalog for details). The complete Attendance Policy can be found in the General Catalog:


**GRADING**

- 35% for homework and programming assignments (roughly six to eight during the semester)
- 40% for one in-class exam and the cumulative final
- 25% for your semester-long team project (project will be evaluated at a few points during the semester)

Late work will be accepted at the professor's discretion with a grading penalty of 5% per school day.

Your final grade will be determined using the following scale:

- 100-90% A
- 89-80% B
- 79-70% C
- 69-60% D
- 59-below F

**Final Exam:**
The final exam for this course will be held at the time indicated in the Registrar’s final Exam Schedule found at: [https://www.truman.edu/majors-programs/academic-resources/academic-calendar-schedules/final-exam-schedules/spring-2022/](https://www.truman.edu/majors-programs/academic-resources/academic-calendar-schedules/final-exam-schedules/spring-2022/).

For this class, that is 11:30am-1:20pm on Monday, May 8 in VH 1328.
ASSIGNMENTS

Programming Assignments

You will write Python programs to meet descriptions from prompts. The first assignment will investigate both uninformed and informed search algorithms, building on code provided by the professor. The second assignment will involve writing an evaluation function for a game, exploring adversarial search. The team project will involve a significant Python implementation. All programming assignments will be evaluated on the correctness of their functionality, the quality of their design and organization, and the clarity of their representations.

Team Project

Over the semester, teams of 3 or 4 students will propose, investigate, design, and implement a significant project involving exploring a clearly defined AI problem-solving approach for a particular problem of their choosing. There will be a project proposal assignment, progress report assignments, a final project submission, and a presentation in class.

Homework Problems

There will be four textbook homework assignments during the semester. These assignments will involve working through example problems of the form that you will see on exams.

SUBSTANTIVE INTERACTION

Truman policy and federal regulations require that students demonstrate that they are academically engaged in the courses they take. You must meet this requirement within the first calendar week of the semester, beginning at 12:00 am on Tuesday January 17 and ending 11:59 pm Monday January 23. Failure to do so, or to provide an explanation of an extenuating circumstance by that date and time will result in your removal from the course. Under certain circumstances, removal could impact your scholarship eligibility or financial aid. For the purposes of this class, establishing academic engagement requires, at a minimum, attending class in person on either Wednesday, January 18 or Friday, January 20 (preferably both). If you do not attend either of these class sessions, contact me by email to arrange an alternate way of meeting this requirement.

STUDENTS’ AND INSTRUCTOR’S EXPECTATIONS

My Expectations of Students

I expect students to read the relevant sections of the textbook, watch any online class videos explaining the major concepts, attend the class sessions, submit homework and programming assignments when they are due, participate in the regular explanation and reviews sessions, prepare for and pass the hour-long exam and the two-hour-long final exam, form a project team, consult with me to choose a topic for the team project, work diligently throughout the semester on this project, and produce a final submission, along with a presentation. I expect students to engage with the class, ask questions when they have them, and learn the concepts.

What Students Should Expect of Me as Their Instructor

During this course I will: respond to email within 24 hours, usually much more quickly, except maybe 48 hours on weekends; update you on any changes to our course in a timely manner; provide timely feedback on questions, activities, and assessments (no more than a week turn-around time, if work is submitted on time, perhaps a bit longer for team projects); make you aware of concerns I have with your performance or ability to succeed in the course; be available as a source of support in your learning.

If at any time I am forced to step away from the course for more than 48 hours, such as in the case of illness or personal
emergency, I will notify the class as soon as possible and (if necessary) provide an additional point of contact for further information.

**STUDENT ENGAGEMENT**

**Learner Interaction**

I encourage students to interact with me and ask questions in class, in person during office hours and through email. Email is especially useful for technical questions related to homework problems and programming assignments. Email me what you have (as an attachment, usually) and ask about what isn’t working or you find confusing (or just indicate that you are lost). I am happy to Zoom with you during office hours to talk through questions more related to understanding of concepts. It is also helpful to ask these kind of questions during class meetings, so that the whole class can hear the question and my response.

**NETIQUETTE AND CIVIL DIALOG**

As members of the Truman State University community online or on-campus, we all deserve the consideration and respect of one another as we go through this course. We should all be practicing basic courtesy. My office and classroom (including online spaces) are safe and welcoming environments for all students. I am entering this course under the assumption that everyone wants to be here and is excited about our topics. I expect us to treat everyone with respect.

When contacting a classmate or me via email, please follow basic etiquette guidelines that make online communication more efficient: Use a clear (but concise) subject line that conveys some sense of the email’s contents. Use the proper name or title for your addressee; err on the side of being overly formal if you’re not sure what name or title they prefer. Make sure that your audience has all the information they need in order to offer you a helpful response. This includes things like your name, the name of the class, and the assignment in question. Remember that we all (especially your professors) get a lot of email every day. If your message is not clear, you won’t get the best response.

**ACADEMIC HONESTY**

“ACADEMIC HONESTY – Personal and scholarly integrity are expected of everyone in the class. Failure to live up to those responsibilities, risks earning a failing grade on the assignment/examination, a failing grade for the course, and/or in serious cases expulsion for the academic program or University. The University policy on academic dishonesty as published in the Student Conduct Code and General/Graduate Catalog applies.”

(http://catalog.truman.edu/content.php?catoid=13&navoid=625&hl=academic+dishonesty&returnto=search#Academic_Dishonesty).  

Anyone submitting work to be graded which, in my estimation and beyond reasonable doubt, is not his or her work alone will receive an F. **No group work is allowed unless I explicitly indicate that you can work in groups.** When you do hand in group work, you must always indicate that it is group work and who was involved in it. You are welcome to discuss assignments with anyone, but all work you hand in must be your own. Corrolary: If you provide work you produce to others, you are aiding and abetting their dishonesty and thus being dishonest yourself. Providing your work to others or giving answers to others is not acceptable.

**STUDENT SURVEY OF INSTRUCTION**

You will be asked to complete a survey regarding my instruction in this course at the end of the term. The survey is anonymous and I will not see the results until after grades have been completed. It is very important that I receive this feedback as it helps me to continuously improve this class. It also helps the University make decisions about our overall curriculum. Please be sure to participate in this survey opportunity.