

605.645 Artificial Intelligence

Syllabus

Instructor Contact

Stephyn (Steve) G. W. Butcher

General Course Communications
Course Email: EN605445@gmail.com

Emergencies
Cell: 202-257-5937

Please use the course email for all communication unless there is some sort of emergency. This ensures that your message is properly sorted. Please be sure to include *the section number if applicable*. I will make every effort to respond to your inquiry within 24 hours or earlier

I reserve the right to make changes as I see fit throughout the course of the semester. Specific items in this Syllabus may be overridden by Announcements or General Posts in Blackboard. It is your responsibility to read and understand what is required of you and to keep track of any changes that may occur.

Key Points

1. **No late assignments** will be accepted for any reason whatsoever except for significant personal illness, grave illness in the family or a birth/death in the immediate family. Family vacations to Italy do not count.
2. **Cheating is not tolerated** at all. If you are caught, you will get an F in the course. Please read the Syllabus carefully to make sure you know what counts as cheating. *This course has strict rules about outside references.*
3. Hard work is not sufficient for an “A” in the course. **There is no “A’ for effort”.**
4. **Failure to follow the directions is still a failure.**
5. You will get as much out of this course as you put into it. This is your one opportunity to dive into the topic of Artificial Intelligence. ***This course is a lot of work.***
6. There is no such thing as work/life balance in graduate school. The courses in the Engineering for Professionals are not easier—and **are not meant to be easier**—because you have a job. The “balance” comes from only taking one course per semester. When you are done, your degree will say “Johns Hopkins University” just like the graduate students at Homewood.
7. I will make every effort to guide you this semester. This is not a self-paced, self-study MOOC. This is a graduate course where **you are expected to ask questions** if you are stuck. If you knew the answers, there would be no point in taking the class. Ask questions on Blackboard or via the course email.

Now that these sometimes confusing elements are out of the way, let's talk about the course.

Course Description

The incorporation of advanced techniques in reasoning and problem solving into modern, complex systems has become pervasive. Often, these techniques fall within the realm of artificial intelligence. This course focuses on artificial intelligence from an agent perspective, and explores issues of knowledge

representation and reasoning. Students will participate in lectures and discussions on various topics, including heuristic and stochastic search, logical and probabilistic reasoning, planning, learning, and perception. Advanced topics will be selected from areas such as robotics, vision, natural language processing, and philosophy of mind. Students will complete problem sets and small software projects to gain hands-on experience with the techniques and issues covered.

Prerequisites

There are no official prerequisites for the course. However, you should be comfortable with programming. The official programming language for the course is Python 2.7.X.

Course Goals

To understand the various problems that are appropriate for artificial intelligence techniques. To be able to apply artificial intelligence techniques to real world problems. To understand issues in artificial intelligence that arise in the media.

Course Objectives

By the end of the course, students will be able to:

- Identify the different types of artificial intelligence algorithms, their distinguishing characteristics and the problems to which they have been applied.
- Explain and program basic artificial intelligence algorithms.
- Assess the performance of different artificial intelligence algorithms on actual problems.
- Research more advanced algorithms in the current literature.

Course Structure

The course materials are divided into modules. The Modules can be accessed by clicking Course Modules on the left menu. A module will have several sections including the overview, content, readings, discussions, and assignments. Students are encouraged to preview all sections of the module before starting. Most modules run for a period of seven (7) days, exceptions are noted on the Course Outline page. Students should regularly check the Assignment entry in the Course Module for Assignment Due Dates as well as the Calendar.

Textbook

Required

Russell, S. & Norvig, P. (2009). *Artificial intelligence: A modern approach* (3rd ed.). Prentice Hall.

ISBN-10: 0136042597

ISBN-13: 978-0136042594

Textbook information for this course is available online through the appropriate bookstore website: For online courses, search the MBS website at <http://ep.jhu.edu/bookstore>.

The text takes a “kitchen sink” approach to the material. We will make our way through it judiciously; not necessarily covering everything.

Optional

None of the following texts are required but you may find them useful.

You are not required to buy any Python reference materials. You should be able to find out most of what you need to know on the internet or from the instructor. However, the instructor has found the following text to be invaluable at times:

- Beazley, D. (2009). *Python essential reference* (4th ed.). Addison-Wesley Professional.

Additionally, if you program in an object oriented language, the following book may prove invaluable for your career:

- Martin, R. (2009). *Clean code: A handbook of agile software craftsmanship* (1st ed.). Prentice Hall.

The style guideline for the programming assignment is taken largely from it.

Required Software

Python

Python 3.7.X is the official programming language and environment for this course. If you do not have a Python programming environment installed on your computer, you can install one or obtain one from:

<https://www.anaconda.com/download/>

Technical Requirements

Students should refer to Help & Support on the left menu for a general listing of all the course technical requirements.

Student Coursework Requirements

This course has a lot of moving pieces. Make sure you understand all of them and what is expected of you each week (or 2-week period):

1. Readings

Each student is responsible for carefully reading all assigned material and being prepared for discussion. The majority of readings are from the course text. Additional reading may be assigned to supplement text readings. Each student is also responsible for all posts in the forums contained in the Course Discussions section, whether by the instructor or other students.

2. Group Discussions

The Group Discussions focus on *Applications* and *The Big Picture* for Artificial Intelligence. Students will be assigned to smaller discussion groups (5 or so students) for the course. The Group Discussion will have a **two week cycle** to encourage a full discussion of the topic.

The cycle starts with the **Discussion Leader** posting the question and questions about the question by the **Thursday** of the first week. The **Discussion Leader** in most cases should not answer the question but encourage discussion perhaps by pointing out related questions, problems, or facts. The job of the **Discussion Leader** is to keep the discussion going and to evaluate participation.

All the members of the **Group Discussion** will then discuss the question for the next week and a half, making sure to make 2 posts by **Sunday of the first week**, 2 posts by the **Thursday of the second week**, and 2 posts by the **Sunday of the second week**. All "days" are 11:59 PM ET.

All the posts must be substantive and move the discussion forward. The **Discussion Leader** is the ultimate judge. It shouldn't ever be something like "I Agree" (well, you can make a comment "I Agree" it just doesn't count!).

The instructor will act as a meta-moderator for the group discussions.

On the **Monday** following the Group Discussion Cycle, the **Discussion Leader** will email to the instructor the grades for each student in their group. It should include the students *full name*, score from 4 to 0 (A to F), number of posts and a comment *to the student* giving them feedback on how the score was derived and how they might do better next time.

The email will take the following format:

Student 1's Full Name – 4 – 8 Posts. You did a great job of making posts that kept the discussion going forward. I especially liked your comment about the use of State Space Search in the context of marine habitat planning. Keep up the good work.

Student 2's Full Name – 3 – 6 Posts. Your posts were good but did not go the extra mile. They did not engender more discussion. While your comment about Uniform Cost Search was insightful, it was a bit off topic. In the future, try to keep your posts on topic and encourage further discussion.

Student 3's Full Name – 0 – No Posts. You did not make any posts during the discussion.

Student 4's Full Name – 2 – 6 Posts. You made a few posts but they were all late. In the future, you would do better to make more timely posts.

Please do not copy these *verbatim*. Do not make a table or a PDF or an Excel spreadsheet...just send me an email with descriptions like the above so I can enter them into Blackboard's gradebook. If you do not give someone a 3 or 4, please give the kind of feedback you wish you would get.

The subject should say: Discussion <number> Group <number> Grades

Discussion Leaders will not grade themselves. I will grade them according to their success at engendering discussion, making a timely report, etc.

There will be 6 discussion cycles this semester.

3. **Course Discussions**

Students are also expected to keep on top of the Course Discussions. Students should contribute to "In The News" at least twice during the semester and read all links. I may require a Muddy Point or other course discussion throughout the semester to which you should contribute.

Students should read every post in Course Discussions during the week in which the post is made. While there are no specific points associated with this requirement, if the deliverables for an assignment are changed and you have not read the post that changed them, you will lose those points.

Blackboard overrides this Syllabus. Please check Blackboard *every single day*.

4. **Self-Check**

Every week there is a self-check assignment. You should download it from the appropriate Course Module section before you start your reading/watching the video lectures.

The self-check is due on **Thursday by Midnight, Eastern Time**. For the first few weeks, I will post solutions. After the first few weeks, you should post them to your discussion groups where you can help each other out.

The main goal of the self-check is to prepare you for the Programming Assignment.

5. **Programming Assignments**

Every week there will be a programming or "lab" assignment. In many cases, the Self-Check will have walked you through the algorithm you're about to implement.

You will be submitting a single Python file named according to your JHED id. Do not name it anything else. If your JHED id is "jsmith342" then the file you submit will be "jsmith342.py". To keep your assignment separate, place them in folders named "Module 1", "Module 2", etc.

Your code should follow a functional style. This means you should not create classes and objects to implement the algorithms but use functions and basic data structures instead. In Python, you have dicts, lists, tuples, sets, and namedtuples at your disposal. There is almost no reason to use OOP (and many of the algorithms aren't really written for it anyway). This makes for compact, testable programs.

Every function should be documented completely with a Docstring comment that explains the overall purpose of the algorithm (both the "how" and the "why"), the formal arguments, and the return value.

When executed:

```
> python jsmith342.py
```

If you wish to print out more, perhaps to run tests or print out debugging output, you may use a command line flag:

```
> python jsmith342.py --debug true
```

Please see the provided skeleton code for more information.

In general, it is not sufficient to submit a working program so you should not wait until Sunday to get started. The program must be properly documented.

More on Programs

The style of programming to be used in this course is that of "literate programming" whereby the purpose of the "code" is not merely to instruct a computer but also to communicate with other people.

Every function in your notebook should be accompanied a Docstring and comments that explains both the "how" and the "why" of the function. "how" is the technical details including argument types and data shapes. It should include references, where appropriate, to pseudocode from the book or lectures. You should not use any materials other than these for your assignments except for general Python references.

Feel free to use Python 3 type annotations.

The "why" is the importance of the function (if it is merely a helper method like "swap", just explain what it does but if it is an important function like "is_goal()", then explain what "is_goal()" does and why it is important to the algorithm you're implementing.

Keep function short and testable. The "standard" is that a function should do one thing or operate only at one level of abstraction. Refactor to helper methods as needed with informative names. *Good programming practices are not to be abandoned just because these are homework assignments.*

Your program must produce output *exactly as specified*.

These are general guidelines as to how I look at your submission. I will only assign an overall grade and give feedback about the assignment. For the program, you should strive for a working program, then go back and fill in the explanatory comments.

A large amount of the time you will spend in this class depends entirely on your ability to avoid, detect and or eliminate bugs as you do the programming but you cannot get an "A" in the course just be programming correctly. You must convey an understanding of the underlying concepts.

6. Assessments

Every week there will be a 10 question Multiple Choice assessment of your understanding of the main concepts presented during the week.

Grading

Assignments are due according to the dates posted in your Blackboard course site. You may check these due dates in the Course Calendar or the Assignments in the corresponding modules. I will post grades 1 week after assignment due dates (2 weeks at the most...there are a lot of you this semester!).

On Late Submissions...

I do not accept late submissions for a grade without prior consultation, except in the case of extreme emergencies (the birth of a child, incapacitating illness, etc). The following are not legitimate reasons: work, taking other classes, weddings, family reunions, holidays, anniversaries, vacations, etc., etc.

Most of the assignments in this class (General Discussion, Self-Check) have very specific due dates and coordination/participation with groups of other students. These all need to be submitted in a timely manner. If you do not post, there can be no discussion.

A **grade of A** indicates achievement of consistent **excellence and distinction** throughout the course—that is, conspicuous excellence in all aspects of assignments and discussion in every week.

A **grade of B** indicates work that **meets all course requirements** on a level appropriate for graduate academic work. These criteria apply to both undergraduates and graduate students taking the course.

I cannot stress this enough, merely working hard is not grounds for an A. You may very well work very hard for a B. That happens. I once worked very hard for a C in the Advanced Microeconomics (actually, I worked too hard and did not ask enough questions!).

Many students work hard instead of working smart. Ask questions.

Specifications Grading

This class does not use the traditional 100 point scale, I do not weight things. There is no point gaming, percents or averages. You must perform with excellence in all categories of the class in order to get an A.

Here are the categories of work:

Self-Checks	13 (pass/fail)
Group Discussions	6 (A-F)
Programming Assignments	13 (A-F)
Assessments	14 (A-F)
Capstone Project	1 (A-F)

The only category that is a bit “fuzzy” is class participation. I will try to give you some indication half way through the course, if you are participating sufficiently.

4 – Excellent. You completed the assignment in a timely manner, demonstrating a thorough understanding of the technique, tool or concept and conducted an excellent exploration of its use. If it is a discussion, your post was substantive, did not just quote other materials, and contributed to the on-going discussion. You went *above what was required, asked for or expected*.

3 – Acceptable. You completed the assignment in a timely manner, you did exactly what was requested, demonstrating a sufficient understanding of the technique, tool, or concept. There may have been minor deficiencies. If it was a discussion post, the post contributed to the discussion but it may have been a reference to other materials or perhaps even slightly off topic. You may have done more than in the hopes that something was correct.

1,2 – Unacceptable. You either did not complete the assignment, it was not timely or you did what was minimally required. There are significant areas of confusion. A lack of exploration or curiosity about the concept, tool or technique. If it was a discussion post, it may have been off topic.

0 – Oops. You did not submit the assignment on-time or post on-time.

Basically the only way you can get a 0 is by not doing something on-time.

Grades

Final Grades are based on the counts of scores.

For an A, you must *at least* get:

Self-Checks	13 of 13 Submissions (Pass)
Group Discussions	4 of 6 with a score of "A" (4) (the rest with a 2 or higher)
Programming Assignments	10 of 14 with a score of "A" (4) (the rest with a 2 or higher)
Assessments	10 of 14 with a score of "A" (4) (the rest with a 2 or higher)
Class Participation	"A" (4)

For an B, you must *at least* get:

Self-Checks	13 of 13 Submissions (Pass)
Group Discussions	4 of 6 with a score of "B" (3) (the rest with a 2 or higher)
Programming Assignments	10 of 14 with a score of "B" (3) (the rest with a 2 or higher)
Assessments	10 of 14 with a score of "B" (3) (the rest with a 2 or higher)
Class Participation	"B" (4)

Basically, an "A" is for "A" work across the board whereas a "B" may be a mixture of "A" and "B" work. Anything below this standard will be a "C". I reserve the right to assign pluses or minuses as I see fit.

At my discretion, I will "curve" the required proportions in the various categories.

I generally do not directly grade spelling and grammar. However, egregious violations of the rules of the English language will be noted without comment. Consistently poor performance in either spelling or grammar is taken as an indication of poor written communication ability that may detract from your grade.

Help & Support

Students should refer to Help & Support on the left menu for a listing of all the student services and support available to them.

Policies and Guidelines

Assignments, due dates, materials can be changed at any (reasonable) time. Please log into Blackboard *at least once a day* to scan new discussions for such changes.

You are responsible for all discussions/content in the forums on Blackboard.

Academic Misconduct Policy

Specifics

Norvig & Russell is perhaps the most famous artificial intelligence book on the planet. There is little doubt that you could find the answers to almost any question that could be posed somewhere on the internet.

Because of this, there is a "zero tolerance" policy for cheating. If you are caught submitting answers or code that is not your own, you will, at minimum, receive a zero for the assignment. Additionally, the matter

will be referred to the Associate Dean with a recommendation for expulsion from the program. Cheating cheapens your degree, your classmates' degrees and the instructor's degree, which is from Johns Hopkins as well.

Contact the instructor if you have any questions, no matter how slight, about this policy, or if you have questions about a particular assignment.

All of the work you submit this semester is to be your own based on the book, lectures and any discussions with me (except for group discussions). Unfortunately, we invented the Internet so the opportunities for cheating in computer science are probably greater than those for any other field.

Except for Python references, there is a moratorium on all topics of a module while the module is in session. That is, you may not google about state space search during the state space search module.

If you have a question, post something in the discussion boards for the module or email me. If your curiosity is piqued and you want to know more, you can google to your heart's content after the module has passed.

The reason for this is not entirely obvious but it comes from personal experience. There are a finite number of "good" introductory questions and examples for a given topic. I once googled a topic to find that the homework question for my class was the example for someone else's class.

General

All students are required to read, know, and comply with the Johns Hopkins University Krieger School of Arts and Sciences (KSAS) / Whiting School of Engineering (WSE) Procedures for Handling Allegations of Misconduct by Full-Time and Part-Time Graduate Students available at:

<https://ep.jhu.edu/wseacademicmisconductpolicy>

This policy prohibits academic misconduct, including but not limited to the following: cheating or facilitating cheating; plagiarism; reuse of assignments; unauthorized collaboration; alteration of graded assignments; and unfair competition. You may request a paper copy of this policy at this by contacting Mark Tuminello

Phone 410-516-2306

E-mail mtumine2@jhu.edu 

Policy on Disability Services

Johns Hopkins University (JHU) is committed to creating a welcoming and inclusive environment for students, faculty, staff and visitors with disabilities. The University does not discriminate on the basis of race, color, sex, religion, sexual orientation, national or ethnic origin, age, disability or veteran status in any student program or activity, or with regard to admission or employment. JHU works to ensure that students, employees and visitors with disabilities have equal access to university programs, facilities, technology and websites.

Under Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA) of 1990 and the ADA Amendments Act of 2008, a person is considered to have a disability if c (1) he or she has a physical or mental impairment that substantially limits one or more major life activities (such as hearing, seeing, speaking, breathing, performing manual tasks, walking, caring for oneself, learning, or concentrating); (2) has a record of having such an impairment; or (3) is regarded as having such an impairment class. The University provides reasonable and appropriate accommodations to students and

employees with disabilities. In most cases, JHU will require documentation of the disability and the need for the specific requested accommodation.

The Disability Services program within the Office of Institutional Equity oversees the coordination of reasonable accommodations for students and employees with disabilities, and serves as the central point of contact for information on physical and programmatic access at the University. More information on this policy may be found at <http://web.jhu.edu/administration/jhuoie/disability/index.html> or by contacting (410) 516-8075.

Disability Services

Johns Hopkins Engineering for Professionals is committed to providing reasonable and appropriate accommodations to students with disabilities.

Students requiring accommodations are encouraged to contact Disability Services at least four weeks before the start of the academic term or as soon as possible. Although requests can be made at any time, students should understand that there may be a delay of up to two weeks for implementation depending on the nature of the accommodations requested.

Requesting Accommodation

New students must submit a [Student Request for Accommodation](#) form along with supporting documentation from a qualified diagnostician that:

- Identifies the type of disability
- Describes the current level of functioning in an academic setting
- Lists recommended accommodations

Questions about disability resources and requests for accommodation at Johns Hopkins Engineering for Professionals should be directed to:

Mark Tuminello
Disability Services Coordinator
Phone 410-516-2306
Fax 410-579-8049
E-mail mtumine2@jhu.edu or ep-disability-svcs@jhu.edu