



## CCTP-6057: Introduction to AI: Design Principles and Applications

**Professor: Martin Irvine**

**Time and Dates: Tues. 11:00 AM-1:30 PM | January 14 – May 6, 2025**

**Location: Car Barn 318**

### **Course Syllabus, Website, and Resources:**

In addition to in-class discussions and exercises, students will participate in the course with a suite of Web-based platforms and e-text resources:

- (1) A custom-designed **course Website** created by the professor for the syllabus, links to readings and instructional videos, and weekly assignments: <https://irvine.georgetown.domains/6057/>  
Note: The online syllabus will be updated throughout the course in response to student interests and as new or additional sources for course topics become available.
- (2) An e-text course library (shared Google Drive folder) and shared Google Docs. Most readings (and research resources) are available in pdf format in a shared Google Drive folder prepared by the professor (links in the online syllabus). Students will also create and contribute to shared, annotatable Google Docs for certain assignments and discussions (both during class meetings, and working on group projects outside of class).
- (3) The Canvas Discussion platform for weekly written discussion assignments.
- (4) Zoom video conferencing for virtual office meetings (when necessary or more convenient).

**Professor's Contact Information:** email: [irvinem@georgetown.edu](mailto:irvinem@georgetown.edu)

**Office Hours:** Before class meetings, by appointment, and scheduled Zoom video conferences.



## COURSE DESCRIPTION

This course provides a conceptual and design-oriented introduction to the key concepts for computing, digital information, and data from the first foundations of these technologies to the applications now being developed for Machine Learning (ML), Artificial Intelligence (AI), and Cloud computing. This course is especially designed for students from non-technical backgrounds, and provides methods for “deblackboxing” complex technologies through the key concepts and design principles approach. Students will learn how the technologies can be made accessible through an interdisciplinary framework, which combines Systems Thinking, Design Thinking, Semiotic Theory, and the Ethics and Policy viewpoint.

By the end of the course, students will have achieved (1) a conceptual, design-oriented understanding of computing, data, and AI/ML, and (2) a competency in design thinking and systems thinking that can be applied to any sociotechnical system. Since the ability to communicate conceptually clear and truthful explanations of our technologies across technical and non-technical communities is greatly needed in every field and profession, students who have learned these competencies will be able to take on thought leadership roles in any career that they want to pursue.

## COURSE READINGS & REQUIRED BOOK

Most of the course readings (in pdf) and instructional videos are provided with links in the week units in the **course website**: <https://irvine.georgetown.domains/6057/>

There is only one required book, from which I have provided relevant sections in pdfs in the e-text library. (Available at the GU bookstore, but, of course, you can get it from online sellers as well.) You should get your own copy for ongoing reference and your own annotations.

- Peter J. Denning and Craig H. Martell. *Great Principles of Computing*. Cambridge, MA: The MIT Press, 2015.

## COURSE ASSIGNMENTS AND GRADING CRITERIA

### Graded Assignments

Grading will be based on:

- (1) Class participation: weekly writing assignments and group projects (as assigned) (50%).
- (2) An individual final "Capstone" research essay in which students can apply their learning in the course in a research project for developing the concepts and methods of the course (50%).

How to fulfill the evaluation criteria (“rubrics”) for each 50% of the grade will be included in the assignment descriptions in the Website syllabus.



## COURSE SCHEDULE

This course is divided into 14 week modules. For more information on the course structure and assignments, see the [course website](#).

**Course Syllabus Outline:** See the [course website](#) for the content and assignments for each week.

**Note:** Topics and content will be updated during the course so that we can consider new developments in AI/ML as they happen.

Week 1: Introduction to the Course: Learning Goals, Main Topics and Methods

Week 2: Introduction to Key Concepts, Methods, Approaches, and First Steps

Week 3: Computer System Design Principles and Intro to AI/ML Systems

Week 4: Data Design (1): Information & Data: Text Encoding: How Written Symbols Can Become Computable Data

Week 5: Data Design (2): Digital Images: Encoding Images as Computable Data

Week 6: Introduction to Pattern Recognition: Foundations of AI & ML

Week 7: Introduction to Natural Language Processing (NLP) for AI/ML

Week 8: From Chatbots to Large Language Models (LLMs) for Dialogic AI/ML

Week 9: Design Principles for Generative AI Systems: LLMs (ChatGPT, Claude, etc.)

Week 10: Design Principles for AI/ML Text-to-Image Generators (DALL-E, etc.)

Week 11: Using Generative AI Applications for Research, Productivity, and Creativity

Week 12: Deblackboxing Methods for Explainable AI/ML

Week 13: The Ethical, Social, and Policy Issues for AI

Week 14: Wrap Up and Discussion of Final Projects

Final Project due date: May 13.

### Weekly Assignments and Canvas Discussions:

Students are required to post discussion comments on each week's readings and topics in the Canvas Discussions module for the course. Each week's writing assignment has "Question Prompts" to help focus your learning and thinking about the readings and topics of the week.

Instructions for how to write discussion comments are included on the Canvas site and linked in the online syllabus.

**Note: All readings and assignments are to be completed during the week *before* the class meeting for each week unit.** Each week unit defines what we will be covering in class discussions for that week.

**Note:** Weekly writing assignments must be posted in Canvas **at least 6 hours before class**, so that all class members can review each other's work and be prepared for discussion in class.



## COURSE POLICIES AND EXPECTATIONS

### Expectations of Students

This course will be conducted as a seminar and requires each student's direct participation in the learning objectives in each week's course unit. Each syllabus unit is designed as a building block in the interdisciplinary learning path of the course, and students will write weekly short essays that reflect on and apply the main concepts and approaches in each week's unit. Students will also work in teams and groups on collaborative in-class projects and group presentations prepared before class meetings.

You are expected to complete all readings, assignments, and activities **on time before each class meeting**.

Participation is essential to your success in this class. You are expected to actively participate in weekly discussions with fellow students and to contribute to group assignments. In order to get full credit for participation, you will have to complete all of your assignments on time.

### Time Commitment Expectations

Students should plan on spending approximately **10 hours per week** on the work for each week unit.

### Communication Expectations

#### *Communication with Peers*

You will be expected to engage with your fellow classmates via the Canvas Discussions platform, and on other platforms as assigned (e.g., Google docs).

For open dialogue and exchange of ideas, each student is expected to respect the opinions and thoughts of other students and be courteous in all discussions and expressions of points of view. Though we should all be respectful of different opinions when they are part of a discussion about course topics, students should always be free to provide evidence-based reasoning for points of view or interpretations that they think are better or more useful.

#### *Communication with the Professor*

**Important:** Students are required to check their GU email for messages from me about course updates and revisions to instructions for weekly assignments as we progress through the course.

Email me ([irvinem@georgetown.edu](mailto:irvinem@georgetown.edu)) anytime with your questions, concerns, or to schedule a time to meet in person or over Zoom. I will respond to your email within 24 hours, and usually on the same day.



## LEARNING AND RESEARCH RESOURCES

### Georgetown University Library & Online Resources for Learning and Research

The Georgetown Library is one of the best in the US. As soon as possible, get to know how to search for books, articles, and database sources from the library's main page:

<https://library.georgetown.edu/>

Increasingly, publishers are providing books and journals in etext form, and Georgetown Library subscribes to most of the sources that you will need for your studies.

The University Library System's eResources include 500+ research databases, 1.5+ million ebooks, and thousands of periodicals and other multimedia files (films, webinars, music, and images). You can access these resources through the [Library's Homepage](#) by using your NetID and password

If you have a question for a librarian you can go to their "Ask Us" page where you will have the option to chat online, send an email, or schedule a Zoom appointment to discuss a research topic, develop a search strategy, or examine resources for projects and papers. Librarians offer an overview of and in-depth assistance with important resources for course research papers, theses, and other types of research.

### Organizing Research Sources and References

In this course, students are **required** to use [Zotero](#) for capturing, organizing, and citing references for their written work, both for weekly writing assignments and for your final "Capstone" research project. See the [Instructions for downloading on the Library website](#).

Zotero is a free, open-source data platform and app designed by and for students, scholars, writers, and researchers. With the Zotero add-on for your web browser, Zotero enables anyone to add references to their Zotero "Library Folders" directly from any web page (book publisher, library reference, newspaper, magazine, journal, website, or video), and then manage and format the references for inserting citations in all the widely used reference styles for academic and professional writing. (It will save your life as a graduate student!)

### Writing Resources

[The Writing Center](#) offers peer tutoring by trained graduate and undergraduate students who can assist you at any point in the writing process. They help at any stage of your writing process, from brainstorming to revision. Tutors can offer advice on thesis development, use of evidence, organization, sentence structure, grammar, and more. The Writing Center will not proofread or edit papers; rather, they will help to improve your proofreading and editing skills to become a better writer. Appointments can be booked online through their website.



## UNIVERSITY POLICIES

For current University Policies for Students, see the [University Policies Website](#).

The following are two major policies related to your coursework at Georgetown:

## UNIVERSITY HONOR CODE & ACADEMIC INTEGRITY

Students at Georgetown University are expected to maintain the highest standards of academic and personal integrity. Although most Georgetown students conduct themselves in accordance with these standards, occasionally, there are students who violate the code of conduct. Cheating harms the University community in many ways. Academic dishonesty in any form is a serious offense, and students found in violation are subject to academic penalties that include, but are not limited to failure of the course, termination from the program, and revocation of degrees already conferred.

All students are expected to fully adhere to the policies and procedures of [Georgetown's Honor System](#) and to take the Honor Code Pledge:

### Honor Code Pledge

*In pursuit of the high ideals and rigorous standards of academic life I commit myself to respect and to uphold the Georgetown University honor system; to live out a commitment to integrity in all my words and actions; to be honest in every academic endeavor; and to conduct myself honorably, as a responsible member of the Georgetown community as we live and work together; to live out the ideals of Georgetown University I commit myself to be a person for others in my daily life, respectful of difference and disagreement; To care for this venerable campus and all of those with whom I share it; and to fulfill in all ways the trust placed in me to carry on the Georgetown tradition.*

### Plagiarism

All submissions of writing (or creative work) must be your original work. Stealing someone else's work is a terminal offense in the workplace, and it will also ruin your career in academia. Students are expected to work with integrity and honesty in all their assignments.

Any submission suspected of plagiarism will be immediately referred to the Honor Council for investigation and possible adjudication. All students are expected to follow Georgetown's honor code unconditionally. If you have not done so, please read the honor code material located online at the [Honor Council website](#).

The Georgetown University Honor System defines plagiarism as "the act of passing off as one's own the ideas or writings of another." More guidance is available on the [What is Plagiarism?](#) page in the University [Honor Council, Standards of Conduct site](#). Further doubts and questions about plagiarism, paraphrasing, and the need to credit sources can be found at [Plagiarism.org](#).



## STUDENT LIFE POLICIES

The current Student Life Policies for life and work at Georgetown are on the [Student Life Policies](#) website. Here are important policies to know while you are at Georgetown and with CCT:

### **Accommodations: Students with Disabilities**

Under the Americans with Disabilities Act (ADA), people with disabilities have the right to specific accommodations that do not fundamentally alter the nature of the course. Some accommodations might include note takers, audio ebooks, extended time on assignments, and interpreter services among others. Students are responsible for communicating their needs to the [Academic Resource Center](#), the office that oversees disability support services, (202-687-8354):

[arc@georgetown.edu](mailto:arc@georgetown.edu); <https://academicsupport.georgetown.edu/disability/>

before the start of classes to allow time to review the documentation and make recommendations for appropriate accommodations.

For the current and up-to-date policy information, please refer to the [Georgetown University Academic Resource Center website](#). Students are highly encouraged to discuss the documentation and accommodation process with an Academic Resource Center administrator.

### **Accessibility and Inclusion**

One of the central tenets of Georgetown’s educational mission is *cura personalis*, a Latin phrase meaning “care of the whole person.” Georgetown is committed to showing care and concern for each student by creating an inclusive and accessible learning environment that follows universal design principles to meet the needs of its diverse student body. As a professor, I am committed to creating a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and respects students’ identities (including race, gender, class, sexuality, religion, ability, etc.).

### **Title IX/Sexual Misconduct**

Georgetown University and its faculty are committed to supporting survivors and those affected by sexual misconduct, which includes sexual assault, sexual harassment, relationship violence, and stalking. See the [University Policy on Sexual Misconduct](#) page for policies and procedure; and [student help resources for sexual assault](#). More information about reporting options and help resources can be found on the [Sexual Misconduct Website](#).

## WELL-BEING SUPPORT SERVICES

Georgetown offers support services for students for well-being. Here are some resources available to you: [Student Health Services](#) and [Counseling and Psychiatric Services](#) (crisis line: 202-687-6985).