



**CMSC 491 / 691 — Reasoning with Generative AI**  
**Fall 2025 (3 credits)**  
**Version 0.1 — August 2025**

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## 1 Course Information

### 1.1 Meetings and Instructors

Monday, Wednesday, 10-11:15 AM

Location: Sondheim 206

<https://courses.cs.umbc.edu/graduate/691/fall25/reasoning/>

This class will use a Discord server for QA

<https://discord.com/channels/1409607778342932553>

where course announcements and extracurricular questions and discussions can happen. Each person is responsible for staying up-to-date on the discussion.

For any sensitive issue, please email me ([ferraro@umbc.edu](mailto:ferraro@umbc.edu)).

**Prerequisites** CMSC 341 and one of CMSC 473, 478, 475 (or graduate versions); or instructor permission

Name	E-Contact	Office Hours
Prof. Frank Ferraro	<a href="mailto:ferraro@umbc.edu">ferraro@umbc.edu</a>	ITE 358 Monday, 11:15-12:00 by appointment

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## 1.2 Texts, Readings, and Discussion

The readings will be from publicly available top-tier research papers.

## 1.3 Topics

This course will cover state-of-the-art generative AI models, and methods for using them to “reason” about diverse problems of varying difficulty. We will examine standard benchmark tasks across core machine learning, natural language processing and computer vision, along with new, domain-specific problems. Different prompting approaches, such as chain-of-thought and tree-of-thought, will be covered, as will different ways of incorporating feedback and training these models, through reinforcement learning from human feedback and preference optimization.

## 1.4 Goals

After taking this course, you will:

1. be introduced to some of the core problems and solutions in GenAI (big picture)
2. Be discerning: learn different ways that “reasoning” success and progress can be measured
3. Get hands-on experience with GenAI solutions
4. Read and analyze research papers
5. Practice your (written) communication skills
6. (691) Practice your presentation skills

## 2 Coursework and Evaluation

The course is a project-based course: the grade will consist of writing logs that covers current approaches; a course project; and for grad students a presentation. The overall evaluation is as follows:

<b>Component</b>	<b>491—Undergrad</b>	<b>691—Grad</b>
Writing Logs	50%	30%
Graduate Presentation	—	20%
Project	50%	50%

**Intracomponent Weighting** A component’s score will be the maximum between the macro-average and the micro-average of the individual assessments within that component. If your assignment scores are 65/90, 95/100, 95/110, and 100/110, then the micro-average is

$$\frac{65 + 95 + 95 + 100}{90 + 100 + 110 + 110} = \frac{355}{410} \approx 86.585\%,$$

while the macro-average (averaging them individually) is

$$\frac{1}{4} \left( \frac{65}{90} + \frac{95}{100} + \frac{95}{110} + \frac{100}{110} \right) \approx 86.124\%.$$

Because the micro-average is higher, the assignment score contribution would be 86.585%. (The four example scores above do not indicate the total value of the assignments.)

The exception to this is the project: all milestones must be turned in and met for the above maximization to occur. If not all milestones are met, then the micro-average will be used.

**Grading Scale:** The following grading scale is used on the normalized final, rounded percentages:

**If you get at least a/an... you are guaranteed a/an... or higher.**

90	A-
80	B-
70	C-
65	D
0	F

### 3 Dates and Deadlines

Please talk to me if you will have an extended absence.

#### 3.1 Important Dates

Due dates will be announced on the course website and the Discord server. Due dates are specified on each assignment/item. Submission instructions will be provided with each assigned item.

#### 3.2 Extensions and Late Policy

This class does not use late days. I reserve the right to issue class-wide extensions. For any extended absences please email the main professor.

## 4 Academic Honesty

### 4.1 Summary

*I take academic honesty seriously. Do not cheat, deceive, plagiarize, improperly share, access or use code, or otherwise engage in academically dishonest behaviors.*

- *Doing so may result in lost credit, course failure, suspension, or dismissal from UMBC.*
- *Instances of suspected dishonesty will be handled through the proper administrative procedures.*
- *Every member of a group is responsible for the group's submission. If one member is academically dishonest, all members may be sanctioned, regardless of individual actions.*

### 4.2 Policy in this Class

This course follows the academic honesty policy from the Office of Undergraduate Education, available from <https://academicconduct.umbc.edu/>. The following is a concise summary of the policies adopted:

By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal.

Especially for computer science classes, there are generally questions about what is and is not allowed. You are encouraged to discuss the subject matter and assignments with others. The discussion board provides a great forum for this. However, you may not write or complete assignments for another student; allow another student to write or complete your assignments; pair program; copy someone else's work; or allow your work to be copied. (This list is not inclusive.)

As part of discussing the assignments, you may plan with other students; be careful when dealing with pseudocode. A good general rule is that if anything is written down when discussing the assignments with others, you **must** actually implement it separately and you must **not** look at your discussion notes.

You are free to use online references like Stack Overflow for questions that are not the primary aspect of the course. If, for example, you're having an issue with unicode in Python, or are getting a weird compilation error, then sites like Stack Overflow are a great resource. Don't get stuck fighting your tools.

You may generally use external libraries (and even parts of standard libraries), provided what you use does not actually implement what you are directed to implement.

Be sure to properly acknowledge whatever external help—be it from students, third party libraries, or other readings—you receive.

### **4.3 Predictive/AI-based Tools**

For this class, if you use ChatGPT (or similar chatbots or AI-based text generation tools), you must describe exactly how you used it, including providing the prompt, original generation, and your edits. This applies to prose and code. Not disclosing is an academic integrity violation. If you do disclose, your answer may receive anywhere from 0 to full credit, depending on the extent of substantive edits, achievement of learning outcomes, and overall circumvention of those outcomes.

Use of AI/automatic tools for grammatical assistance (such as spell-checkers or Grammarly) or small-scale predictive text (e.g., next word prediction, tab completion) is okay. Provided the use of these tools does not change the substance of your work, use of these tools may be, but is not required to be, disclosed.

### **4.4 Incremental Logging of Work**

In a job, you will likely be required to use some form of collaborative editing system system, like git, Google Docs, or Overleaf. These systems provide a way of incrementally adding content to a file (or files), along with commentary describing the changes. In this class, some deliverables, including code or text, must be incrementally logged / committed in a verifiable, remote history. This could be through UMBC Google Docs, private Github repositories, or Overleaf (if you have a premium account). Assessments may require you to provide this history. Assessments may additionally require a minimum of non-trivial commits or changes.

## **5 Other Policies**

### **5.1 Students with Accomodations**

The office of Student Disability Services (SDS, <https://sds.umbc.edu>) works to ensure that students can access and take advantage of UMBC's educational environment, regardless of disability. From the UMBC ECR,

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that creates equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at [sds.umbc.edu](https://sds.umbc.edu) for registration information and office procedures.

SDS email: [disAbility@umbc.edu](mailto:disAbility@umbc.edu)

SDS phone: 410-455-2459

If you will be using SDS approved accommodations in this class, please contact the instructor to discuss implementation of the accommodations. During remote instruc-

tion requirements due to COVID, communication and flexibility will be essential for success.

## 5.2 Inclusion

Please see the Office of Equity and Inclusion's website for the most up-to-date information and policies.

College can be stressful. Don't add to that stress by engaging in harassing or hostile behaviors. They are not welcome in the classroom and are completely inappropriate.

More and more organizations are dealing with hostile behavior. One such organization in the NLP community (NAACL, the North American Association for Computational Linguistics) has a good explanation of the behaviors that are not welcome (replace "conference," "event" or "ACL" with "class"):

[Harassment and hostile behavior include]: speech or behavior that intimidates, creates discomfort, or interferes with a person's participation or opportunity for participation in a conference or an event. We aim for ACL-related activities to be an environment where harassment in any form does not happen, including but not limited to: harassment based on race, gender, religion, age, color, appearance, national origin, ancestry, disability, sexual orientation, or gender identity. Harassment includes degrading verbal comments, deliberate intimidation, stalking, harassing photography or recording, inappropriate physical contact, and unwelcome sexual attention. The policy is not intended to inhibit challenging scientific debate, but rather to promote it through ensuring that all are welcome to participate in shared spirit of scientific inquiry.

UMBC Policy in addition to federal and state law (to include Title IX) prohibits discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment, or related retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources. The Title IX Coordinator can be reached at [titleixcoordinator@umbc.edu](mailto:titleixcoordinator@umbc.edu) or 410-455-1717.

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in making a report, please use the Online Reporting/Referral Form. Please note that, if you report anonymously, the University's ability to respond will be limited.

Notice that Faculty and Teaching Assistants are Responsible Employees with Mandatory Reporting Obligations

All faculty members and teaching assistants are considered Responsible Employees, per UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination. Faculty and teaching assistants therefore required to report all known information regarding alleged conduct that may be a violation of the Policy to the Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC. Reports are required regardless of the amount of detail provided and even in instances where support has already been offered or received.

While faculty members want to encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report past and present sexual harassment, sexual assault, domestic and dating violence, stalking, and gender discrimination that is shared with them to the Title IX Coordinator so that the University can inform students of their rights, resources, and support. While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of Confidential Resources available to support you:

Retriever Integrated Health (Main Campus): 410-455-2472; Monday – Friday 8:30 a.m. – 5 p.m.; For After-Hours Support, Call 988.

Center for Counseling and Well-Being (Shady Grove Campus): 301-738-6273; Monday-Thursday 10:00a.m. – 7:00 p.m. and Friday 10:00 a.m. – 2:00 p.m. (virtual) Online Appointment Request Form

Pastoral Counseling via The Gathering Space for Spiritual Well-Being: 410-455-6795; i3b@umbc.edu; Monday – Friday 8:00 a.m. – 10:00 p.m.

#### Other Resources

Women’s Center (open to students of all genders): 410-455-2714; womenscenter@umbc.edu; Monday – Thursday 9:30 a.m. – 5:00 p.m. and Friday 10:00 a.m. – 4 p.m.

Shady Grove Student Resources, Maryland Resources, National Resources.

#### Child Abuse and Neglect

Please note that Maryland law and UMBC policy require that faculty report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police even if the person who experienced the abuse or neglect is now over 18.

## **5.3 Covid-19 or Other Illnesses**

### **5.3.1 Attendance/In-Person Expectations**

This class is fundamentally designed to be an in-person class. As such, it is expected that you will attend class in person when possible. However, it is also expected that you will not attend class if you are feeling ill, have symptoms associated with Covid-19, or are required or suggested to quarantine. Some accommodations will be made to facilitate remote participation, such as live-streaming the slides, though such accommodations may not be able to capture all of the in-person class experience. These accommodations are not a substitute for in-person attendance (when possible).