Ira A. Fulton Schools of Engineering
Arizona State University

Course Syllabus - Summer C 2023

CSE 579: Knowledge Representation and Reasoning

Contact Information

Instructor (IoR):	Ali Altunkaya	**Preferred Name:**	[How instructor would like to be addressed, e.g., Dr. Smith or John]
		Pronouns:	
Live Events:	TBD		
Graduate Student Assistants (GSA):	Lakshmi Narayana Rao Boyapati	**Preferred Name:**	Lakshmi Narayana
		Pronouns:	
Live Support Sessions:	TDB		
Graduate Student Assistants (GSA):	TBD	**Preferred Name:**	
		Pronouns:	
Live Support Sessions (GSA):	TBD		
Content, Project, and Assignment Questions:	Ed Discussion		
Technical Support:	Coursera Learner Help Center		

Note: Please make sure you are logged in so that support personnel recognize you as an ASU learner.

General Support: mcsonline@asu.edu
Note: When sending an email about this class, please include the prefix "CSE 579" in the subject line of your message. Please use this email address for questions that are private in nature. If it is a question that would benefit your classmates, and is not private in nature, please post in Ed Discussion.

Course Description

Knowledge representation and reasoning (KRR) is one of the fundamental areas in Artificial Intelligence. It is concerned with how knowledge can be represented in formal languages and manipulated in an automated way so that computers can make intelligent decisions based on the encoded knowledge. KRR techniques are key drivers of innovation in computer science, and they have led to significant advances in practical applications in a wide range of areas from Artificial Intelligence to Software Engineering. In recent years, KRR has also derived challenges from new and emerging fields including the semantic web, computational biology, and the development of software agents. This is a graduate-level course that introduces fundamental concepts as well as surveys of recent research and developments in the field of knowledge representation and reasoning.

Specific topics covered include:

- Classical logic and knowledge representation
- First-order logic
- Answer set programming
- Reasoning about actions and planning
- Ontology, Semantic Web languages, and knowledge graph
- Combining logic and probability

Technologies covered include:

- Clingo
- Answer Set Programming

Ira A. Fulton Schools of Engineering
Arizona State University

Learning Outcomes

Learners completing this course will be able to:

- Discuss the foundations of KRR.
- Explain different categories of representation and reasoning tasks.
- Assess the trade-off between representation and reasoning.
- Identify which knowledge-based techniques are appropriate for which tasks.
- Apply KRR systems to challenging real-world problems.

Estimated Workload/ Time Commitment Per Week

Average of 18 - 20 hours per week

Required Prior Knowledge and Skills

This course will be very challenging, and learners are expected to learn the necessary technologies on their own time.

Proficient Mathematical Skills and Theoretical Understanding

- Algebra
- Classical Logic

Strong Application Skills

- Programming
- Statistics

Proficient Experience

- Ability to effectively read code
- Confidence in executing at least one programming language: Python, Java, C#, C++, C

Technology Requirements

Hardware

- Standard with major OS
- Webcam
- Microphone
- Reliable, strong Internet connection

Software/Other

- To complete coursework (e.g., assignments and projects), these applications/languages are required:
    - Clingo
    - Protégé

The course project will be completed using the language that the learner chooses. However, the course team will not be able to help the learner if they choose any language that is not Python, Java, or C#.

Textbook and Readings

At the graduate level, inquiry, research, and critical reading are part of the learning experience; however, this course does not have a required textbook. Any required readings are provided within or are accessible through the course or the ASU Library.

For interested learners, the instructor & the faculty course designer recommends the text(s):

F. Baader, I. Horrocks, C. Lutz, U. Sattler, An Introduction to Description Logic. Cambridge, United Kingdom: Cambridge University Press, 2017.

V. Lifschitz, Answer Set Programming. Basingstoke, United Kingdom: Springer Nature, 2019.

M. Gebser, R. Kaminski, B. Kaufmann, and T. Schaub, Answer Set Solving in Practice: Synthesis Lectures on Artificial Intelligence and Machine Learning. Williston,VT: Morgan & Claypool Publishers, 2012.

F. Harmelen, V. Lifschitz, and B. Porter, Handbook of Knowledge Representation, vol. 3, Amsterdam, Netherlands: Elsevier, 2008.

Course Schedule and Important Dates

Course teams will not be working on ASU's days off* and those are listed in the Course Schedule. Please review the ASU Days Off for more details.

Week/Title	Begins at 12:01 AM Arizona (AZ) Time	Ends at 11:59 PM Arizona (AZ) Time
Welcome and Start Here	May 11, 2023	May 21, 2023
Week 1: Welcome and Introduction to KRR	May 16, 2023	May 21, 2023
Week 2: First-Order Logic and Knowledge Representation **ASU Holiday Monday May 29, 2023*	May 22, 2023	May 28, 2023
Week 3: Theory of Answer Set Programming	May 29, 2023	June 4, 2023
Week 4: Practice of Answer Set Programming	June 5, 2023	June 11, 2023
Midterm	June 11, 2023	June 18, 2023
Week 5: Reasoning about Actions	June 12, 2023	June 18, 2023
Week 6: KRR with Uncertainty	June 19, 2023	June 25, 2023

Course Survey	June 15, 2023	June 25, 2023
Week 7: Ontology Languages	June 26, 2023	July 2, 2023
Week 8: Applications of KKR	July 3, 2023	July 9, 2023
Final Exam	July 2, 2023	July 10, 2023
Request for Faculty Review: MCS Portfolio Project Report Inclusion Request Optional, degree-seeking learner degree requirement If you submit by the first deadline and it is not accepted, you are encouraged to review the feedback and re-submit it a second time by the last submission deadline. Anything submitted past the last submission deadline will **not** be reviewed for approval in your portfolio to meet your degree requirements. You will have to repeat this process for another course and a project from that course.	July 3, 2023	July 26, 2023
Faculty Feedback for the Review: MCS Portfolio Project Report Inclusion Request Optional, degree-seeking learner degree requirement	July 26, 2023	August 9, 2023
Course Closes Once the course closes, you will no longer be able to access coursework you have submitted, so please download copies of what you would like from the course (e.g., Request for Faculty Review: MCS Portfolio Project Report Inclusion Request)		August 23, 2023

Grades are due July 12, 2023. Please see the ASU Academic Calendar for additional information.

Assignment Deadlines and Late Penalties

Unless otherwise noted, all graded work is due on **Sundays at 11:59 PM Arizona (AZ) time**. For learners with accommodations through Student Accessibility and Inclusive Learning Services (SAILS)

and/or the Pat Tillman Veterans Center (PTVC), please work with your SAILS consultant and/or PTVC Advocacy Team, Connect, and your instructor.

Graded Quizzes

A single-automatic late penalty of 5% is applied after the scheduled due date and time.

- **Week 1 Graded Quiz** - due at the end of Week 1
- **Week 2 Graded Quiz** - due at the end of Week 2
- **Week 3 Graded Quiz** - due at the end of Week 3
- **Week 4 Graded Quiz** - due at the end of Week 4
- **Week 5 Graded Quiz** - due at the end of Week 5
- **Week 6 Graded Quiz** - due at the end of Week 6
- **Week 7 Graded Quiz** - due at the end of Week 7

Assignment(s)

A single-automatic late penalty of 5% is applied after the scheduled due date and time.

- **Week 4 Graded Assignment: Simple Answer Set Programming** - due at the end of Week 4 on Sunday, June 11, 2023 at 11:59PM AZ Time. Graded, full human-graded feedback, rubric-based
- **Week 5 Graded Assignment: More Challenging Answer Set Programming** - due at the end of Week 5 on Sunday, June 25, 2023 at 11:59PM AZ Time. Graded, full human-graded feedback, rubric-based
- **(Optional/Bonus) Week 7 Graded Assignment: Building an OWL Ontology** - This assignment will be a bonus; 2% on the total final grade; due at the end of Week 7 on Sunday, July 2, 2023 at 11:59PM AZ Time. Graded, full human-graded feedback, rubric-based

Project(s)

A single-automatic late penalty of 5% is applied after the scheduled due date and time. Each milestone is human-graded with a rubric and due at 11:59PM AZ Time of the week it is due.

- **Milestone 1 - Solution to Introductory Clingo Program** - due at the end of Week 2
- **Milestone 2 - Solutions to Basic Clingo Problems** - due at the end of Week 3
- **Milestone 3 - Individual Progress Report** - due at the end of Week 5
- **Milestone 4 - Individual Progress Report** - due at the end of Week 7

Exams

A single-automatic late penalty of 100% is applied after the scheduled due date and time.

- **Midterm Exam -** available from Sunday, June 11, 2023 at 12:01 AM AZ Time - Sunday, June 18, 2023 at 11:59 PM AZ time
- **Final Exam -** available from Sunday, July 2, 2023 at 12:01 AM AZ Time - Monday, July 10, 2023 at 11:59 PM AZ Time

Course Content

Each course in the MCS program is uniquely designed by expert faculty, so learners can best master the learning outcomes. As a result, course features and experiences are not the same across all MCS courses. Learners are expected to plan accordingly to accommodate for these differences.

Feedback Descriptions

The feedback descriptions are specific to auto-graded or auto-feedback items in the course.

- **Limited**: you will be able to see your Total Score, which includes the overall total percent (%) and the number (#) of points.

- **Partial**: you will be able to see your Question Score, which includes the correct or incorrect status and the total points for each question.
- **Full**: you will be able to see your Options and Feedback, which includes any itemized additional feedback.

Content and Assessment Details

If you have specific questions related to instructional and assessment items in this course that you would like to be considered to be addressed in the weekly Live Event hosted by the instructor, please clearly indicate your request in your Ed Discussion thread.

Lecture Videos

The concepts you need to know are presented through a collection of video lectures. You may stream these videos for playback within the browser by clicking on their titles or download the videos. Where available, you may download the individual slides that go along with the videos. To further support learning, all of the videos include transcripts and most include PDF lecture slides. Weekly overview videos, assignment videos, and project-related videos do not have PDF lecture slides because they are not lectures and have associated documents specific to them. The interview videos build context for the course and do not have PDF slides.

A media guide is included at the beginning of each week in the Overview section. These guides are designed to give you a snapshot description of each week's media components and to provide the week's PDF lecture slides or note-taking materials where available, so you can plan your learning and quickly go back and review material as you prepare for your coursework.

Readings

Suggested readings may accompany topics. They are supplementary or enrichment materials for you to further understand the course topics.

Recommended Resources

Please explore the recommended resources to deepen your knowledge and enhance your skills on the topics covered each week. Although the content in these resources will not be explicitly assessed, they may support your learning and successful completion of coursework.

Discussions

Ed Discussion

Ed Discussion (Ed) is being used in place of Coursera Discussion Forums. The purpose of Ed Discussion is to provide a place for learners to ask questions and receive answers from course staff and peers about course content and course work. The course team is engaged in discussions, but it is also a space to clarify, support, and enrich learner-to-learner communication and learning. There are designated categories for course items. You must select a category and subcategory to start a thread.

Discussions in Ed are designed to provide:

- Clarification
- Feedback
- Enrichment and deeper learning
- Connections between concepts or key ideas
- Reflection opportunities of real-world experiences
- Respectful debate and perspective building
- Resource sharing
- Networking

There are no late penalties. Ed is not counted toward your final grade in the course.

Discussion Prompts in Ed Discussion

There are discussion prompts alongside other items in the Coursera course. Please review the directions and prompts carefully. Posts/Threads should be categorized by their designated week and title in Ed. After responding, you can see and comment on your peers' responses.

There are no late penalties. Responses to discussion prompts are not counted toward your final grade in the course.

Designated Assignment and Project Discussion in Ed Discussion

Use Ed to discuss items relating to the course assignments and projects. Questions/Threads should be categorized by their designated title in Ed. Please check for questions already asked and answered, or marked as resolved.

There are no late penalties. Responses in Ed are not counted toward your final grade in the course.

Knowledge Checks

Designed to support your learning, these are short, ungraded quizzes to test your knowledge of the concepts presented in the lecture videos. You may take your time, review your notes, and learn at your own pace because knowledge checks are untimed. With unlimited attempts, you may retake these as often as you would like at any point in the course. You are encouraged to read the [full, partial, or limited feedback], review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these as opportunities to study for other assessments and tasks in the course.

There are no late penalties. Knowledge Checks are not counted toward your final grade in the class.

Practice Quizzes

There is a practice quiz to help prepare you for each graded quiz. You may retake these as often as you like at any point in the course. You are encouraged to read the full feedback, review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these as opportunities to study for other assessments and tasks in the course.

There are no late penalties. Practice quizzes are not counted toward your final grade in the class.

Graded Quizzes

Each week includes one (1) graded quiz. Each graded quiz includes 10 or 11 single-select and multiple-select choice questions. You will be allowed one (1) attempt for each of these quizzes. There is a sixty to sixty-five (60-65) minutes time limit for each quiz. Graded quizzes in this course include limited feedback. For academic integrity purposes, once grades are made available, learners will see their overall total scores. Correct and incorrect answers and feedback to each question will not be provided. Read the Graded Quiz and Exam Policy for more information. If you have specific questions that you would like to be considered to be addressed in the weekly by the instructor or course staff, send them to mcsonline@asu.edu. A single-automatic late penalty of 5% for each day late is applied to quizzes submitted after the scheduled due date and time. These quizzes count toward your final grade in the class.

Individual Assignment(s)

This course includes two (2) graded assignments and one (1) optional assignment. All assignments are provided in the first week of the course in the *Welcome and Start Here* section, so you can preview what is expected and design your own learning schedules to complete these on time. The assignments have a submission space at the end of weeks 4, 5, and 7. A single automatic late penalty of 5% for each day late is applied to projects submitted after the scheduled due date and time. Two assignments count toward your final grade in the class. The Week 7 assignment is optional with the option of an additional 2% toward your final grade.

Individual Project

This course includes one (1) individual project. The project will include four (4) milestone assignments. The project overview is provided in the first week of the course in the *Welcome and Start Here* section, so you can preview what is expected and design your own learning schedules to complete these on time. The project has a submission space at the end of the week it is due. As a set of 4, the milestones may be included in the Request for Faculty Review: MCS Project Portfolio submission, which is optional*. A single automatic late penalty of 5% is applied to projects submitted after the scheduled due date and time. The Project counts toward your final grade in the class.*

Request for Faculty Review: MCS Portfolio Project Report Inclusion Request

This is an optional task for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements. Review your onboarding course and the Welcome and Start Here section of your course for more details. The submission space is towards the end of the course.

Although there are no late penalties, these requests must be submitted by the designated deadline. The Request for Faculty Review: MCS Portfolio Project Report Inclusion Request does not count toward your final grade in the class.

- Address the following project in your Request for Faculty Review: MCS Portfolio Project Report Inclusion Request:
    - Project Option: Automated Warehouse Scenario

This is an optional task for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements. Review your onboarding course and the *Welcome and Start Here* section of your course for more details. The submission space is towards the end of the course. You can utilize the mcsonline@asu.edu and the course discussion forum for MCS portfolio questions. *If you have specific MCS Project Portfolio questions that you would like to be considered in the weekly Live Event hosted by the instructor, please indicate your request in your discussion forum post or email. Although there are no late penalties, these requests must be submitted by the designated deadline. The Request for Faculty Review: MCS Project Portfolio does not count toward your final grade in the class.*

- Address the following project for the course in your Request for Faculty Review: MCS Project Portfolio:
    - Project Option: Automated Warehouse Scenario
- Request for Faculty Review: MCS Project Portfolio - due on Wednesday,July 26, 2023 at 11:59PM AZ Time.
- Faculty feedback should be received by August 9, 2023.

Practice Exams

In order to help you prepare for your proctored exams, you will have practice exams. Since they are intended to be practice opportunities and to help you learn, they are untimed, ungraded, and include feedback. You may engage with your peers in Ed Discussion to address questions, share resources and strategies, and provide feedback to help one another learn. You are encouraged to read the full feedback, review your answer choices, and compare them to the correct answers. You are encouraged to submit questions in Ed Discussion for the course team to address during Live Events and/or Live Support Sessions. Use the feedback to guide your learning and to study for the proctored exam.

There are no late penalties. Practice exams are not counted toward your final grade in the class.

Proctored Exam(s)

You have two (2) proctored, timed exams. These consist of a Midterm and a Final Exam. Proctored exams include limited feedback. Read the Graded Quiz and Exam Policy for your course for more information.

No late exams will be permitted or accepted and will result in a score of zero (0) points. This does not include established accommodations for learners receiving accommodations through Student Accessibility and Inclusive Learning Services (SAILS) and and/or the Pat Tillman Veterans Center (PTVC).Proctored exams count toward your final grade in the class.

Exam Details	Midterm Exam	Final Exam
Content Covered	Weeks 1, 2, 3, and 4	Weeks 5, 6, 7
Question Type	multiple choice, multiple select, and short answer	multiple choice, multiple select, and short answer
Number of Questions	34 total questions (33 content questions + 1	30 total questions (29 content questions + 1

	academic integrity question = 34 total questions)	academic integrity question = 30 total questions)
Availability Start	June 11, at 12:01 AM AZ Time	July 2, at 12:01 AM AZ Time
Availability End	June 18, at 11:59 PM AZ time	July 10, at 11:59 PM AZ Time
Last Available ProctorU Appointment	June 18, at 9:01 PM AZ time.	July 10, at 9:01 PM AZ time.
Duration	120 minutes + plan for at least 15 minutes for proctoring set up	120 minutes + plan for at least 15 minutes for proctoring set up

Exam Allowances

- **Hard copy and/or soft copy texts, books, and/or other reference materials downloaded on your device or on a website:** None
- **Calculators**: None
- **Notes:** Yes, please review the details for using handwritten OR printed (typed) notes below:
    - Handwritten notes: Two sides of one sheet of 8.5x11 (or equivalent) paper of handwritten notes OR one side of one sheet of 8.5x11 (or equivalent) of typed notes.

      OR

    - Printed Notes: One side of one sheet of 8.5x11 (or equivalent) of printed/typed notes
- **Web:** None
- **Software:** None
- **Other technologies, devices, and means of communication:** None
- **Whiteboard, scratch paper, writing utensils, erasing resources**: Learners are *strongly* encouraged to use the whiteboard option instead of scratch paper.

- If using a whiteboard, learners may have erasable whiteboard markers and what is needed to erase writing on the whiteboard; please have extra whiteboard markers and eraser resources in your testing area.
- If using scratch paper, learners may have an unlimited amount of blank scratch paper of any size, writing utensils (e.g., pens, pencils, markers, and/or highlighters) and erasers; please have extra ones in your testing area should you run out of ink, the pencil breaks, etc.
- Before the exam concludes and the proctoring session ends, all scratch paper must be destroyed and all whiteboard markings must be erased. The last question in the exam will be a confirmation of learners executing these ASU academic integrity actions.

- **Other**:
  - Learners are to independently take the exam in a single session without leaving the testing space (e.g., no bathroom breaks) to ensure proctoring of the entire session. Once you open the exam, your testing session begins.
  - You will be allowed one (1) attempt to take and complete each exam.
  - Learners are to stay within a clear view of the proctor throughout the duration of the proctored exam session.
  - You will be unable to open the exam until the exam proctor enters the password during the date and time you scheduled to take your exam with ProctorU.
  - Your exam will automatically be submitted if it is not completed before the deadline.
- **Reminder**: All virtual machines must be closed *prior* to starting proctoring.

Proctoring

ProctorU is an online proctoring service that allows learners to take exams online while ensuring the integrity of the exam for the institution.

- You are expected to scan your testing space using your webcam for the proctor. Proctoring also requires you to have adequate sound and a working microphone. Please plan accordingly.

- You are strongly encouraged to schedule your exam(s) within the first two weeks of the course to ensure you find a day and time that works best for your schedule. Time slots can fill up quickly, especially during high volume time periods.
    - You *must* set up your proctoring at least 72 hours prior to the exam.
- **The exam proctor will input the exam password**.
- Additional information and instructions are provided in the *Welcome and Start Here* section of the course.
- **When you are going to schedule exams, you *must* pick "Coursera" as your institution.**
- Learners with exam accommodations through Student Accessibility and Inclusive Learning Services (SAILS) and Pat Tillman Veterans Center (PTVC), should not schedule exams until they receive an email invitation specifically for them from ProctorU.
- Your ID needs to be in English. See your MCS Onboarding Course for more information.

Course Grade Breakdown

Course Work	Quantity	Team or Individual	Percentage of Grade
Graded Quizzes	7	Individual	20%
Assignments	2	Individual	20%
Course Project Total	1	Individual	30%
Project Milestones - *All milestones contribute to final 30% course project total*	*Milestone 1: Solution to Introductory Clingo Program*	*Individual*	*5%*
	Milestone 2:Solutions to Basic Clingo Problems	*Individual*	*15%*

	Milestone 3: Individual Progress Report	*Individual*	*30%*
	Milestone 4: Individual Project Report	*Individual*	*50%*
Mid-term Exam	1	Individual	15%
Final Exam	1	Individual	15%
Bonus/Optional (Week 7 Graded Assignment: Building an OWL Ontology**)**	1	Individual	2%

*The project(s) count for 30% or more of the overall course grade, so this is a portfolio eligible course. See the MCS Graduate Handbook for more information about the portfolio requirement if you are a degree student.

Grade Scale

You must earn a cumulative grade of ≥70% to earn a “C” in this course. You must earn at least a “C” to receive graduate credit. This course has no grade curving. All graded coursework will be included to calculate grades. The lowest weekly quiz grade will be dropped. Grades will not be rounded. Grades in this course will not include pluses or minuses.

The instructor reserves the right to adjust individual grades based on, but not limited to violations of academic integrity.

Letter Grade	Percentage
A	90% - 100%
B	80% - 89.99%

C	70% - 79.99%
D	60% - 69.99%
E	<60%

Grades below 59.99 result in a letter grade of E.

Live Events

This course has two types of live events: **Instructor Live Events** and **GSA Live Support Sessions**. Check the Live Events page in your course for your local time and access details. Although we try to be consistent for our learners' planning purposes, the Live Event schedule is subject to change throughout the course, so stay up-to-date on the event details by checking your Course Announcements and the Live Events page in your course.

You may join all live events from the course's Live Events page. The event's title will become active as a Zoom link ten (10) minutes before each event starts. You will also receive an email with a link to the Live Event or Live Support Session the day before the event starts.

Read about the specific policies related to Live Events in the Policy section of this syllabus: Live Events, Policy Regarding Expected Classroom Behavior, and the Student Code of Conduct for more detailed information.

Instructor Live Events - Weekly

Instructor Live Events are a valuable part of the learning experience because learners can meet with the course instructor and fellow classmates to learn more about course topics, special topics within the field, and discuss coursework. If you are able to attend these events, you are strongly encouraged to do so. If you have specific questions or topics of interest to be discussed during these events, please indicate your request in an Ed Discussion thread. Although it may not be possible to address all requests during the live event, the instructor is interested in tailoring this time to your questions and interests. The instructor will be following a set agenda, so please be mindful of that when engaging in the live event.

Instructor Live Events will be recorded and uploaded to the course. These can be found at the end of each week in the course.

GSA Live Support Sessions - Weekly

Live Support Sessions offer a chance for learners to get their questions answered from the course team. Although the course team is responsive to trends in Ed Discussion and mcsonline@asu.edu emails, these events focus on addressing learners' specific questions related to content: clarifications, reteaching, assessment review, etc. These sessions are not intended to address program or course design questions or feedback. GSAs do not have the authority to weigh in or make decisions regarding those items, so please do not include those at this time. These sessions are specific to helping learners learn materials and understand various course assessments. Feedback of that nature is best addressed in the communication channel: mcsonline@asu.edu and please include it in your course survey.

Live Support Sessions are recorded, but not uploaded into the course. It is at the discretion of the IoR if these sessions will be added during the course session.

Course Outline with Assignments

Please review the ASU Days Off for more details. Course teams will not be working on ASU's days off.

Welcome and Start Here (May 11 - May 21)

Topics

- ☐ Academic Integrity
- ☐ Course Syllabus
- ☐ Required Prior Knowledge and Skills and Technology Requirements
- ☐ Course Assignment(s) and/or Project(s) Overview
- ☐ Exam Information and ProctorU

Other Tasks

- ☐ Required Checkpoint: Technology Access and Installation
- ☐ Activity: Zeemap

- ☐ Discussion: Get to Know Your Classmates in Ed Discussion
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s)
    - For learners needing accommodations, submit requests through Connect and review the Student Accessibility and Inclusive Learning Services (SAILS) and/or the Pat Tillman Veterans Center (PTVC).
    - Learners with exam accommodations through SAILS or PTVC should **not** schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Required Checkpoint: Getting Started Quiz

Graded Coursework

- ☐ N/A

Week 1: Introduction to KRR (May 16 - May 21)

Topics

- ☐ Defining Knowledge Representation and Reasoning
- ☐ Different Kinds of Reasoning Problems
- ☐ Propositional Logic - Part I
- ☐ Propositional Logic - Part II
- ☐ Leading Voices from the Field: Drs. Lifschitz, Schaub, and Horrocks

Other Tasks

- ☐ Schedule your proctoring with ProctorU for your proctored exam(s).
    - For learners needing accommodations, submit requests through Connect and review the Student Accessibility and Inclusive Learning Services (SAILS) and/or the Pat Tillman Veterans Center (PTVC).
    - Learners with exam accommodations through SAILS or PTVC, should not schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Any other ungraded items, such as taking the team survey add in this section

Graded Coursework

- ☐ Weekly Graded Quiz

Week 2: First-Order Logic and Knowledge Representation (May 22 - May 28)

**ASU Holiday, Monday May 28, 2023.*

Topics

- ☐ Introduction to First-Order Logic
- ☐ Syntax of First-Order Logic
- ☐ Semantics of First-Order Logic
- ☐ Representing Knowledge in First-Order Logic
- ☐ Herbrand Models

Other Tasks

- ☐ Schedule your proctoring with ProctorU for your proctored exam(s).
    - For learners needing accommodations, submit requests through Connect and review the Student Accessibility and Inclusive Learning Services (SAILS) and/or the Pat Tillman Veterans Center (PTVC).
    - Learners with exam accommodations through SAILS or PTVC, should not schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Any other ungraded items, such as deliverables that are ungraded for feedback
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done so.
- ☐ Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Participate and review the weekly discussion forum
- ☐ Submit Live Events questions before the weekly Live Events and Live Support Sessions

Graded Coursework

- ☐ Week 2 Graded Quiz

- ☐ Course Project: Milestone 1 - Solution to Introductory Clingo Program

Week 3: Theory of Answer Set Programming May 29 - June 4)

Topics

- ☐ Introduction to Answer Set Programming
- ☐ Stable Models of Definite/Positive Programs
- ☐ Definite/Positive Programs in the Language of Clingo
- ☐ Definite/Positive Programs in the Language of Clingo Allowing Intervals
- ☐ More about Clingo Programs
- ☐ Negation as Failure

Other Tasks

Graded Coursework

- ☐ Week 3 Graded Quiz
- ☐ Course Project: Milestone 2 - Solutions to Basic Clingo Problems

Week 4: Practice of Answer Set Programming (June 5 - June 11)

Topics

- ☐ Week 4 Graded Assignment: Simple Answer Set Programming
- ☐ Week 4 Graded Quiz
- ☐ Midterm Exam (see below)

Other Tasks

Graded Coursework

- ☐ Week 4 Graded Assignment: Simple Answer Set Programming

- [ ] Week 4 Graded Quiz
- [ ] Midterm Exam (see below)

Midterm Exam (June 11 - June 18)

Reminders

- [ ] Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- [ ] Covers content from weeks 1,2,3,4.
- [ ] Review the details and allowances information for this exam.
- [ ] Prepare for the exam and complete the practice exam. *[*
- [ ] Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- [ ] Covers content from weeks 1 - 4
- [ ] Review the details and allowances information for this exam.
- [ ] Prepare for the exam.
- [ ] Participate and review the weekly discussion forum
- [ ] Submit Live Events questions before the weekly Live Events and Live Support Sessions

Week 5: Reasoning about Actions (June 12 - June 18)

Topics

- [ ] Introduction to Reasoning about Actions
- [ ] Simple Transition System in ASP
- [ ] More Complex Transition Systems in ASP
- [ ] Expressive Possibilities

Other Tasks

Graded Coursework

- [ ] Week 5 Graded Assignment: More Challenging Answer Set Programming

- ☐ Week 5 Graded Quiz
- ☐ Course Project: Milestone 3 - Individual Progress Report

Week 6: KRR with Uncertainty (June 19 - June 25)

Topics

- ☐ Review of Probability
- ☐ Bayesian Networks
- ☐ Markov Logic
- ☐ LPMLN

Other Tasks

- ☐ Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).
- ☐ Participate and review the weekly discussion forum
- ☐ Submit Live Events questions before the weekly Live Events and Live Support Sessions

Graded Coursework

- ☐ Week 6 Graded Quiz

Week 7: Ontology Languages (June 26 - July 2)

Topics

- ☐ Introduction to Ontology
- ☐ Resource Description Framework
- ☐ Graph
- ☐ Description Logics
- ☐ Reasoning Problems
- ☐ Web Ontology Language (OWL)

Other Tasks

- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- ☐ Request for Request for Faculty Review: MCS Portfolio Project Report Inclusion Request.
    - Optional for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements.
- ☐ Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- ☐ Request for Faculty Review: MCS Portfolio Project Report Inclusion Request.
    - Optional for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements.
- ☐ Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).
- ☐ Participate and review the weekly discussion forum
- ☐ Submit Live Events questions before the weekly Live Events and Live Support Sessions

Graded Coursework

- ☐ (Optional/Bonus) Week 7 Graded Assignment: Building an OWL Ontology (Optional/Bonus)
- ☐ Week 7 Graded Quiz
- ☐ Course Project: Milestone 4 - Individual Project Report

Week 8: Applications of KRR (July 3 - July 9)

Topics

- ☐ More on ASP
- ☐ Some KRR Applications

Other Tasks

- ☐ Request for Request for Faculty Review: MCS Portfolio Project Report Inclusion Request.
    - Optional for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements.
- ☐ Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).

Graded Coursework

- ☐ No graded coursework

Final Exam (July 2 - July 10)

Reminders

- ☐ Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- ☐ Covers content from weeks 5,6,7.
- ☐ Review the details and allowances information for this exam.
- ☐ Prepare for the exam and complete the practice exam.

Policies

All ASU and Coursera policies will be enforced during this course. For policy details, please consult the MCS Graduate Handbook and the MCS Onboarding Course.

Graded Quizzes and Exams

Each course in the MCS program is uniquely designed by expert faculty so that learners can best master the learning outcomes specific to each course. By design, course features and experiences are different across all MCS courses.

In the MCS program, we strive to provide learners with exercises and applied practice beyond quizzes and exams that align with the hands-on nature of the computer science industry. Ungraded

practice opportunities *may* include, but are not limited to: in-video-questions (IVQs), knowledge check quizzes (KCs), weekly (i.e., unit) practice quizzes, practice exams, and other assignments or exercises. For all these learning activities, the questions and correct answers are provided to learners. When available, auto-generated typed feedback is built into the course to further help learners learn in real-time. Please thoroughly review your course to ensure that you are aware of the types of practice opportunities available to you.

For academic integrity purposes, once grades are made available, learners will see their overall total scores. Like other standardized tests, such as the GRE and SAT, learners will receive a singular grade for the graded quizzes and exams, but the questions, correct and incorrect answers, and feedback to each question will ***not*** be provided.

If learners desire 1:1 feedback for their questions on graded assessments, please submit questions to mcsonline@asu.edu. Rather than receiving the exact questions learners had correct and incorrect and the answers to those questions, learners will likely receive the concepts that were covered in the assessment questions so they will know what they need to review prior to other assessments and how to apply this information in their professional environments.

Absence Policies

There are no required or mandatory attendance events in this online course. Different types of live events hosted by any course team member do not take attendance. [Opportunity to insert expectations for teamwork/group work and what “attendance” or “absences” look like. A line can be added about grade adjustments based on individual contributions to teamwork/group work...*The instructor reserves the right to adjust individual grades based on, but not limited to: workload imbalance, inappropriate behavior, lack of productivity, etc.]

Learners are to complete all graded coursework (e.g., projects and exams). If exceptions for graded coursework deadlines need to be made for excused absences, please reach out to the course team by the end of the second week of the course using the mcsonline@asu.edu email address. Review the exam availability windows and schedule accordingly. The exam availability windows allow for your own flexibility and you are expected to plan ahead. Personal travel does not qualify as an excused absence and does not guarantee an exception.

Review the resources for what qualifies as an excused absence and review the late penalties in the Assignment Deadlines and Late Penalties section of the syllabus and the course:

a. Excused absences related to religious observances/practices that are in accord with ACD 304–04, “Accommodation for Religious Practices” (please see Religious Holidays and Observances).

b. Excused absences related to university sanctioned events/activities that are in accord with ACD 304–02, “Missed Classes Due to University-Sanctioned Activities”.

c. Excused absences related to missed class due to military line-of-duty activities that are in accord with ACD 304–11, “Missed Class Due to Military Line-of-Duty Activities,” and SSM 201–18, “Accommodating Active Duty Military”.

Live Event Expectations

The environment should remain professional at all times. Inappropriate content/visuals, language, tone, feedback, etc. will not be tolerated, reported and subject to disciplinary action. Review the Policy Regarding Expected Classroom Behavior section of the syllabus and the Student Code of Conduct for more detailed information.

Policy Regarding Expected Classroom Behavior

The aim of education is the intellectual, personal, social, and ethical development of the individual. The educational process is ideally conducted in an environment that encourages reasoned discourse, intellectual honesty, openness to constructive change, and respect for the rights of all individuals. Self-discipline and a respect for the rights of others in the university community are necessary for the fulfillment of such goals. An instructor may withdraw a student from a course with a mark of “W” or “E” or employ other interventions when the student’s behavior disrupts the educational process. For more information, review SSM 201–10.

If you identify something as unacceptable classroom behavior in any communication channel (e.g., Ed Discussion, Zoom, Live Events, etc.), please notify the course team using the mcsonline@asu.edu email. For more specifics on appropriate participation, please review our Netiquette infographic.

Our classroom community rules are to:

- Be professional
- Be positive
- Be polite
- Be proactive

Academic Integrity

Students in this class must adhere to ASU's academic integrity policy, which can be found at https://provost.asu.edu/academic-integrity/policy). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In addition, all engineering students are expected to adhere to both the ASU Academic Integrity Honor Code and the Fulton Schools of Engineering Honor Code. All academic integrity violations will be reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). The AIO maintains a record of all violations and has access to academic integrity violations committed in all other ASU colleges/schools.

Specific academic integrity announcements for this class are…[* When discussing sanctions please use language like, *recommended sanctions for these violations will be*…this allows for the fact that the AIO may want to discuss the sanction with you and it also improves the ability to increase the penalty when it is a multiple violation]

Copyright

The contents of this course, including lectures (Zoom recorded lectures included) and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions is authorized only for the use of students enrolled in this course during their enrollment in this course. Recordings and excerpts of recordings may not be distributed to others. (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5-308 F.14 for more information).

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's/learner's original work, unless the student/learner first complies with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Policy Against Threatening Behavior, per the Student Services Manual, (SSM 104-02)

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services (see SSM 104-02). Interfering with the peaceful conduct of

university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Disability Accommodations

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with ASU Student Accessibility and Inclusive Learning Services. Students should communicate the need for an accommodation at the beginning of each course so there is sufficient time for it to be properly arranged. These requests should be submitted through the online portal. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities. ASU Student Accessibility and Inclusive Learning Services will send the instructor of record a notification of approved accommodations and students are copied on these letters. It is recommended that students reply to the faculty notification letters, introduce themselves to their instructor, and share anything they might want to disclose.

Harassment and Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

Mandated sexual harassment reporter: As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual

violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

Disclaimer

The information in this syllabus may be subject to change without advance notice. Stay informed by checking course announcements and the syllabus section of your course.

Course Creator(s)

Joohyung Lee, Ph.D

Joohyung Lee is a tenured associate professor in the School of Computing, Informatics and Decision Systems Engineering at ASU, where he has led the Automated Reasoning Group since 2005. He is interested in designing and building intelligent systems, which can perform automated reasoning based on the knowledge represented in a formal language, thereby intelligently handling open-ended tasks by "thinking." He has been working on knowledge representation, logic programming, commonsense reasoning, reasoning under uncertainty, cognitive robotics, computational logics, security, and question answering. His research has been supported by the National Science Foundation, Department of Defense, IARPA, Siemens, Bosch, and ETRI. He is a recipient of Outstanding Paper Honorable Mention Award from AAAI 2004. He received his Ph.D from the University of Texas at Austin.