

# **SIE-422/522 Engineering Decision Making under Uncertainty**

## **Fall 2022**

### **Syllabus**

#### **Class Location and Times:**

Classroom: M Pacheco ILC, Rm 141  
2-2.50pm MWF, 22 Aug – 7 Dec

#### **Description of Course**

This course presents the foundations of decision analysis contextualized for engineering work. Students will learn to frame and model engineering problems as decisions that traverse physics by incorporating firm's objectives and the personal preferences of the engineer. In addition, the course will present formal and informal limitations of decision methods traditionally used in engineering, such as rank matrices, and will provide students with alternative theories and methods that foster better decisions. Finally, the course will present the notion of risk assessment and management as inherent to engineering decision making, instead of as an independent engineering process.

#### **Course Objectives:**

The purpose of this course is to introduce students to the basic concepts, mindsets, and techniques of decision analysis in engineering settings.

#### **Expected Learning Outcomes:**

Having successfully completed this course, the student will be able to:

1. Frame and model engineering problems as decisions.
2. Use the concept of belief to navigate through uncertainty in engineering problems.
3. Reject the distinction between technical and non-technical problems and embrace an integrative approach to engineering that embraces preferences and expected value as the bases for engineering decisions.
4. Know the limitations of traditional engineering decision methods, such as rank matrices, and use decision trees, utility theory, and sensitivity analysis for making engineering decisions.
5. Understand and assess risk as part of the decision analysis activity.

#### **Course Prerequisites or Co-requisites**

Pre-requisite: None.

#### **Instructor and Contact Information**

**Instructor:** Dr. Alejandro Salado

**Office:** ENG 121

**Phone:** 520.626.0728

**Email Address:** [alejandrosalado@arizona.edu](mailto:alejandrosalado@arizona.edu)

**Home Page:** <https://sie.engineering.arizona.edu/faculty-staff/faculty/alejandro-salado>

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**Office Hours:** By appointment.

### Course Text

There are two required textbooks in this course:

- 1) Howard RA, Abbas A. *Foundations of Decision Analysis*. Pearson, 2016.
- 2) Gladwell, M. *Blink: The power of Thinking Without Thinking*. Back Bay Books, 2007.

### Course Software

Academic license for PrecisionTree from Palisade Corporation will be used. The course is not a tutorial on this or any other software. Students will be expected to familiarize themselves with the toolset and resolve problems independently. Students are encouraged to collaborate on making best use of the tool set. A discussion forum in D2L will be set up for this purpose.

Remote students must also use a drawing enabled device during the semester so that they can contribute to group discussions and with the overall class in virtual whiteboards.

### Course Format and Teaching Methods

All course information is located on the course homepage, which is in Desire2Learn at <https://d2l.arizona.edu/>. **NOTE:** The course site includes information about the course structure, dynamics, and grading beyond that reported in this syllabus. All students must review such information in advance of class.

The course will use a flipped classroom instructional approach. The student will read the required material and attempt to complete the homework before coming to the class. Classes will be used to practice and complete the homework students were unable to complete on their own, using those activities to consolidate concepts and initiate in-class discussions to gain deeper insights in the material.

Class meetings will not be recorded.

A detailed schedule of the different activities during the semester will be posted in D2L.

In addition to all policies and information in this document, the instructor expects of every student in this course the following:

- To attend class prepared – be aware of all assignment due dates, including reading assignments, and read assigned materials *before* class.
- To participate in class discussions.
- To manage the learning process – seek clarification and feedback if needed.
- To complete assignments on time and in a professional manner.

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- To demonstrate courtesy and respect to peers and instructor by arriving on time, turning off cell phones (or switching to silent mode), using laptops only for course work during class, and remaining attentive and focused during class.

### Grading Scale and Policies:

The grading scheme for this course is based on a total of 1,000 points.

University policy regarding grades and grading systems is available at:

<http://catalog.arizona.edu/policy/grades-and-grading-system>

This course's grading scale is:

Grade:	Standard	Description
A	$900 \leq x$	excellent
B	$800 \leq x < 900$	good
C	$700 \leq x < 800$	satisfactory
D	$600 \leq x < 700$	poor
E	$x < 600$	failure

Where "x" is the total points earned in the course.

Grading will be distributed among four mechanisms:

- 1) *Course participation*: Up to 200 points. Course participation is an important portion of the course grade. This component will be comprised of homework and substantive participation in class discussions.
- 2) *Individual project*: Up to 150 points.
- 3) *Mid-term Exam*: Up to 300 points. Every student is required to attend the mid-term exam. An absent student, without a valid excuse, will be assigned a grade of ZERO points for the exam. Only written and well-justified evidence of the need to be absent will be accepted as a valid excuse. Typically, only medical emergencies would qualify as a well-justified need of absence. The student must inform the instructor of their absence before the examination or as soon as possible thereafter.
- 4) *Final exam/project*: Up to 350 points.
  - a. Every student taking SIE 422 is required to attend the final exam. An absent student, without a valid excuse, will be assigned a grade of ZERO points for the exam. Only written and well-justified evidence of the need to be absent will be accepted as a valid excuse. Typically, only medical emergencies would qualify as a well-justified need of absence. The student must inform the instructor of their absence before the examination or as soon as possible thereafter.
  - b. Students taking SIE 522 will complete a final, take-home project. Students will be given multiple days towards the end of the semester to complete the project. Students must complete the project individually, must not

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collaborate or compare results with other students, and must document any external resources (e.g., literature) they used to answer the questions.

Submitting any of the assignments late will result in a reduced grade, as specified later in this document, unless permission has been granted in written by the instructor prior to the assignment's due date.

**Points in graded assignments are non-negotiable.** If a student believes there are errors in the grading, they should be reported in written to the instructor within 10 days of receiving the graded assignment.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Dispute of Grade Policy: Provide within the acceptable time period for disputing a grade on a paper, project, or exam.

## Lecture schedule

The lecture schedule is provided in D2L.

## Participation

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>. The UArizona policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, see: <http://policy.arizona.edu/human-resources/religious-accommodation-policy>. Absences pre-approved by the UArizona Dean of Students (or Dean Designee) will be honored. See: <http://policy.arizona.edu/employmenthuman-resources/attendance>.

## Classroom Behavior Policy:

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Mainly from the university classroom policy (adopted by the Faculty Senate):

- Not leaving early. Early leaving will distract both the instructor and students
- Not talking with other classmates while the instructor or another student is speaking. If a student has a question or comment, he or she should raise a hand, rather than starting a conversation about it with a neighbor

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- Not packing backpacks to leave until the instructor has dismissed class
- Showing respect and concern for others by not monopolizing class discussion. Students must allow others time to give their input and ask questions. Students should not stray from the topic of class discussion
- Not eating and drinking during class time

## **Academic Integrity and Code of Academic Integrity:**

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>. The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement. Instructor and/or TA will carefully exam all of your homework, reports and exams to prevent plagiarism. For example:

- No copy of other people's homework i grading your homework, TA will exam all of your homework carefully and catch anyone who is copying other people's homework. Even if they are from the same software's output, TA can still judge whether it is a copy of others or not based on your writing and formatting.
- No copy or discussion in the exam TA and other students all will report these behaviors in exams and your exam papers will also be checked carefully for any cheating behavior. Do not sit too close to each other in the exam.

## **Teaching Assistant's Responsibility**

TA is mainly responsible for assisting the instructor in various issues, including grading homework/quizzes/exams, teaching part of software and tutorial, and helping students in programming and homework during the office hour.

## **Send Feedback to US:**

If you have any questions, suggestions or comments related to the class, you are very welcome to contact the instructor or TA. We have several ways for communications:

- 1) In-class feedback
- 2) Office hours
- 3) Emails
- 4) Individual appointment (if you cannot come in office hour)
- 5) Feedback in D2L

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#### **Threatening Behavior Policy:**

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See:

<http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

#### **UArizona Nondiscrimination and Anti-harassment Policy:**

The University is committed to creating and maintaining an environment free of discrimination, see: <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>.

Inclusive Excellence is a fundamental part of the University of Arizona's strategic plan and culture. As part of this initiative, the institution embraces and practices diversity and inclusiveness. These values are expected, respected and welcomed in this course. This course supports elective gender pronoun use and self-identification; rosters indicating such choices will be updated throughout the semester, upon student request. As the course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect.

Additional Resources for Students Statement: Office of Diversity

<http://diversity.arizona.edu/>

<http://www.health.arizona.edu/counseling-and-psych-services>

#### **Accessibility and Accommodations (for students with Disability)**

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268, <https://drc.arizona.edu/>) to establish reasonable accommodations.

#### **Requests for incomplete (I) or withdrawal (W)**

Must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

#### **Additional Resources for Students**

UArizona Academic policies and procedures are available at

<http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at

<http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

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### **Subject to Change Statement**

The information contained in the course syllabus, may be subject to change, as deemed appropriate by the instructor, see <http://policy.arizona.edu/faculty-affairs-and-academics/course-syllabus-policy-undergraduate-template>.