Course Instructor: Faran Ahmed  
Email: faran.ahmed@sabanciuniv.edu  
Office Hours: By Appointment  
Class Hours:  
- Tuesday: 11:40 – 14:30, FENS, L067  
- Thursday: 08:40 - 11:30, FENS, L065  
Recitation: Friday: 12:40 – 14:30, FENS, L058  
Teaching Assistant: TBA

**COURSE DESCRIPTION & LEARNING OUTCOMES**

- The course provides a broad practical overview of topics and techniques in the field of decision analysis. As an engineering course for undergraduate students, the course will address advanced technical subjects that can be found in management science and operations research domains. At the end of the semester, the students will be able to formulate decision making problems that have multiple decisions in time, uncertain events, conflicting objectives and multiple decision makers.

- Upon completion of this course, the student should be able to:
  - Model decision problems to represent a complex business situation.
  - Analyze complex business situations through relevant decision models.
  - Evaluate alternate options using decision analysis tools to arrive at best solution under given criteria.

**PREREQUISITE**

- MATH 306 Minimum Grade of D

**REQUIRED TEXTBOOK:**


**ASSIGNMENTS**

- Assignment will not be marked

**ATTENDANCE**

- Attendance will be taken five times throughout the semester at dates that are declared in the first lecture of the course.
  - Article 26 (1): Attendance is compulsory for all courses, implementations and projects undertaken by the students. The attendance status of students is monitored by the related faculty members.

**OBJECTION POLICY**

- Concerns regarding marks will not be accepted after a week from the posting of the result.

**ACADEMIC CONDUCT**

- Do not plagiarize other people's work. Students should be aware that anyone who engages in actions prohibited by the University's policy on academic honesty will be subject to disciplinary action.
MARKING SCHEME

- Attendance 10%
- 02 Quizzes 20%
- Midterm 30%
- Final 40%

MAKE-UP POLICY (from the instruction letters for undergraduate education)

- Article 20: A make-up exam is given to students who cannot take an exam for reasons acceptable to the faculty member.
- Upon furnishing relevant proof (e.g., medical certificate) makeup may be allowed
- Schedule is already shared; I STRONGLY advise you to plan your schedule such that you do not miss any assessment.

CONTENT OF THE COURSE

I - Modeling Decisions

- Elements of Decision Problems
- Structuring Decisions
  - Influence Diagrams (ID)
  - Decision Trees (DT)
- Making Choices
  - EMV
  - Solving ID
  - Solving DT
- Risk Profiles and Dominance
- Sensitivity

II - Modeling Uncertainty

Subjective Probability

- Bayes Theorem
- Assessing Discrete Probability
  - Direct
  - Lottery
  - Comparison of Game like Lotteries
- Assessing Continuous Probability
  - Assessing the CDF through reference lotteries
- Discrete Approximation of Continuous Probabilities
  - Pearson-Tukey
  - Bracket Medians Method
- Monte Carlo Simulation – ITM
- How do we judge our Beliefs?
  - Representativeness
  - Availability
  - Anchoring and Adjustment
  - Framing
- Value of Information
  - EVPI
  - EVII
III - Modeling Preference

- Risk Attitudes.
  - St. Petersburg Paradox
  - Risk Seeking, Risk Averse, Risk Neutral
  - Expected Utility, Certainty Equivalent, Risk Premium
  - Assessing the Utility (Using CE, Using PE)
  - Risk Tolerance and Exponential Utility Function

- Decreasing and Constant Risk Aversion

- Utility Axioms, Paradoxes and Implications
  - 7 Axioms of Utility (Ordering and Transitivity, Monotonicity, Invariance, etc.)
  - Allais Paradox (sure thing principle)
  - Implications on utility assessment and making decisions

- Conflicting Objectives
  - Additive Utility Function (No interaction among the attributes)
  - Scales – Nominal, Ordinal, Interval, and Ratio Scales.
  - Assessing weights
    - Pricing Out
    - Swing Weighting
    - Lottery Weights
  - Assessing Individual Utility Functions
    - Proportional Scores
    - Ratio Scores
    - Lottery
  - Multi-attribute Utility Function (Direct Assessment)
  - Multilinear Utility Function (with interaction among the attributes)
  - Independence Conditions
    - Preferential Independence
    - Utility Independence
    - Additive Independence
  - Substitutes and Complements
  - AHP
    - Eigenvalue /Eigenvector Method
    - Measure of Inconsistency
    - Geometric and Arithmetic Mean Approaches