

# MIE566F: Decision Making Under Uncertainty

## (Fall 2024)

**Learning Objectives** 1. Correctly formulate and solve Bayesian decision analysis models with commercial software  
2. Attain an understanding of methods for solving such models

**Lectures:\*** Tue 9-10 am in BA1240, Tue 11-12 am in GB120, Thu 11-12 am in GB120

For weeks of Sep 30, Oct 14, Oct 21 the Thu lecture will take place Wed 3-4 in WB119

**Labs** Mon 1-3 pm in GB150

**Tutorial** Fri 3-5 pm in MY350

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**References** Making Hard Decisions - An Introduction to Decision Analysis  
by Robert T. Clemen and Terence Reilly, 3rd edition, Duxbury Press - 2013  
Game Theory - An Introduction, by Steven Tadelis  
Princeton University Press, 2013

**Marking Scheme:**

Project Part 1	8%	Due Monday Oct 21	See opposite side
Lab Mid-Term	35%	Friday Oct 25th 3-5 pm in GB150	
Project Part 2	8%	Due Monday Nov 11	See opposite side
Project Part 3	9%	Due Monday Dec 2	See opposite side
Lab Final Exam	<u>40%</u>	TBA	
	100%		

**Course Plan**

	<u>Week of</u>	<u>Wk #</u>	<u>Topic</u>	<u>Lab</u>	<u>Tut</u>
	02-Sep	1	Subjective Probability and Bayes Rule	-	Re Wk1
	09-Sep	2	Attitude to Risk	-	Re Wk2
	16-Sep	3	Decision Trees	-	Re Wk3
	23-Sep	4	Influence Diagrams	-	Re Wk4
	30-Sep	5	Bayesian Networks	<a href="#">netica</a>	Re Wk5
	07-Oct	6	Continuous Variables	<a href="#">netica</a>	Re Wk6
	14-Oct	7	Multi-Attribute Utilities	<a href="#">PyMC</a>	Re Wk7
Part 1 Due	21-Oct		Review	<a href="#">PyMC</a>	midterm
	28-Oct		Reading Week		
	04-Nov	8	Static Games with Complete Information	-	Re Wk8
Part 2 Due	11-Nov	9	Dynamic Games with Complete Information	<a href="#">gametheoryexplorer</a>	Re Wk9
	18-Nov	10	Static Bayesian Games with Incomplete Info	<a href="#">gametheoryexplorer</a>	Re Wk10
	25-Nov	11	Dynamic Bayesian Games with Incomplete Info	<a href="#">gametheoryexplorer</a>	Re Wk11
Part 3 Due	02-Dec	12	Review	<a href="#">gametheoryexplorer</a>	

Note: The Communications Language in all Course Lectures, Tutorials and Labs is English.

# Self-defined Project

**Objective: To apply the course methods to multi-faceted complex decision problems.**

## Part 1

### What

1. Decisions to be made from 2-4 alternatives in one stage, plus a data collection stage
2. Multiple discrete uncertainties
3. Interrelations between decisions and uncertainties
4. Multiple sources of discrete valued data that reduce the uncertainties
5. Single objective that guides your decision

### How

1. How discrete subjective prior probabilities were elicited
2. How Data was collected (discrete valued data)
3. How the utility function was elicited
3. Solution by Influence Diagram model using Netica

## Part 2

### What

1. Decisions to be made from 2-4 alternatives in one stage, plus a data collection stage
2. Multiple discrete and continuous uncertainties
3. Interrelations between decisions and uncertainties
4. Multiple sources of discrete and continuous valued data that reduce the uncertainties
5. Multiple objectives that guide your decision

### How

1. How continuous subjective probabilities, some conjugate and some non conj., were elicited
2. How Data was collected - continuous valued data
3. How the multi-objective utility function was elicited
4. Detailed Description of the Influence Diagram for Solving the problem
5. Solution as Bayes Net using OpenBugs (rerunning with alternate strategies)

## Part 3

### What

1. Decisions to be made from 2-4 alternatives in one stage, no data collection stage
2. Single Discrete Uncertainty
3. One or more non-cooperative opponents
3. Interrelations between your and opponent decisions, objectives and uncertainties
5. Single objective that guides your decision

### How

1. How discrete subjective prior probabilities were elicited
3. How the utility function was elicited
4. Detailed Description of the Game in Normal and Extensive Forms
5. Solution by GamesTheoryExplorer

## Group Composition - use rotating roles:

1 student in the role of Decision Maker

1 student as Analyst

1 student as Auditor