Course Overview: Decision making in an uncertain environment is perhaps the most fundamental and important task that a professional in management science faces. Imagine yourself as an Amazon department manager who needs to decide how to stock up at various distribution centers, or as a management consultant who must help a manufacturing firm decide how much to invest in a new plant capacity. In both these, and many other instances, the challenge arises from the fact that one has to make these decisions in the face of uncertainty: for example, the demands for respective products in the future are uncertain.

The very first step when faced with such tasks is to build satisfactory probabilistic models, and this course is designed to equip you with basic probabilistic reasoning and statistical modeling skills. More precisely, the topics that will be covered include:

1) Univariate models: Discrete & continuous distributions, expectation and variance, Markov and Chebyshev’s inequality, law of large numbers, central limit theorem, confidence intervals for the mean and experimental / survey design

2) Simulation from univariate distributions: Inverse transform sampling & acceptance / rejection sampling.

3) Multivariate models: Joint and conditional distributions, independence, correlation, covariance, multivariate normal distributions, simulation and its applications.

4) Risk analysis: Value at risk and expected shortfall.

5) Statistics: Statistical hypothesis testing, building linear and logistic regression models that are fundamental for predictive analytics for business, an introduction to stochastic optimization via sample average approximation, and an introduction to forecasting methods for management.

Prerequisites: Calculus, including multiple integration. Working knowledge of a scientific computational tool like matlab is desired; though not required at the beginning of the course, the student is expected to learn matlab by self as the course progresses.

Instructor: Karthyek Murthy

Class meets at: Fayerweather 310, Tue & Thu 10:10 - 11:25

Getting help: I sit in Mudd 331, and I prefer to receive questions in person during office hours on Tuesdays 5:30 - 7 PM. In other circumstances, you can email me at karthyek.murthy@columbia.edu for appointments and other questions.

Course Assistants: TBA

Recitations: TBA

Homework assignments: There will be 8-10 homework assignments. We will drop the lowest score and compute the grade based only on the remaining scores. Late home-works will not be accepted.

While you may discuss some of the homework problems with your classmates, the teaching assistant, or with me, it is necessary that the solutions are written all by yourself. Also, for every problem you discuss, please be reminded that you are required to acknowledge who you discussed it with. Disclosing this information will not affect your grade.
**Exams:** Midterm date: TBA, Final exam date: TBA
The exams are closed book and notes. Only two sheets of paper with information in both sides (i.e. four pages only) are allowed in each exam. The information can be anything you want.

**Grading:** Midterm exam 40%, Final exam 45%, Homework assignments 15%

**References:** No textbooks required for this course. Some useful references are:


3) *Data, Models and Decisions* by Dimitris Bertsimas and Robert M. Freund, Dynamic ideas, 2004


**Note:** To make sure that classes provide an environment that is conducive for learning and exchange of ideas, we discourage distracting behaviours – such as use of electronic devices (including laptops) for purposes not authorised by the instructor, arriving late to the class, leaving early, moving in and out of the class, etc. – that adversely affect the learning environment.