MSO201A: Probability and Statistics
2021 - 2nd Semester

Instructor: Dr. Subhajit Dutta
Email : duttas@iitk.ac.in
Course material and announcements will be posted on HelloIITK (https://hello.iitk.ac.in/mso201a2021/)

Tutors:

Dr. R. K. Bansal (rkb@iitk.ac.in) - Section S1
Dr. Ketan Rajawat (ketan@iitk.ac.in) - Section S2
Dr. Farha Sultana (farhas@iitk.ac.in) - Section S3

Tutorials: Wednesday 08:00-09:00 over Zoom

Discussion Hours: Friday 08:00-09:00 over Zoom (if necessary, other slots will be introduced later)

Reference Books:

- Introduction to Probability and Statistics for Engineers and Scientists by S. M. Ross
- Introduction to Mathematical Statistics by R. V. Hogg, A. Craig and J. W. McKean
- An Introduction to Probability and Statistics by V. K. Rohatgi and A. K. Md. E. Saleh
- Introduction to Probability and Statistics by S. Milton and J. C. Arnold
- Introduction to Probability Theory and Statistical Inference by H. J. Larson
- Introduction to Probability Theory by P. G. Hoel, S. Port and C. Stone

Course Content

Probability: Axiomatic definition, properties, conditional probability, Bayes' rule and independence of events. Random variables, distribution function, probability mass and density functions, expectation, moments, moment generating function, Chebyshev's inequality. Special distributions; Bernoulli, binomial, geometric, negative binomial, hypergeometric, Poisson, exponential, gamma, Weibull, beta, Cauchy, double exponential, normal. Joint distributions, marginal and conditional distributions, moments, independence of random variables, covariance and correlation. Functions of random variables. Weak law of large numbers and Central limit theorems.

Statistics: Descriptive statistics, graphical representation of the data, measures of location and variability. Population, sample, parameters. Point estimation; method of moments, maximum likelihood estimator, unbiasedness, consistency. Confidence intervals for mean, difference of means, proportions. Testing of hypothesis; Null and alternate hypothesis, Neyman Pearson fundamental lemma, Tests for one sample and two sample problems for normal populations, tests for proportions.

Course Objective

In this course, basic concepts of Probability Theory and Statistics will be introduced to develop statistical thinking among students. We plan to devote 2/3 of the course towards Probability Theory, and 1/3 of the course towards Statistics.

Prerequisites

Students are expected to have knowledge of differential and integral calculus of MTH101: Mathematics I level.

Coding in R

Download and install the statistical software R (https://www.r-project.org/). We will have a couple of numerical assignments in R related to some ideas that will be introduced in this course. These assigments will carry no points, just for the fun of learning!

Course Policies

I. Evaluation and Weightages

- FIVE quizzes of 30 minutes duration (usually on Saturdays at 09:00), each carrying a weightage of 10%;
- a mid-semester examination of two hours duration (on one of the days between February 21-27, to be announced by the DOAA), carrying 20% weightage; and
- an end-semester examination of three hours duration (on one of the days between May 3-12, to be announced by the DOAA) carrying 30% weightage.

All quizzes will be held using HelloIITK, while other examinations will be held using HelloIITK/Gradescope.

II. Academic Performance Evaluation Scheme

The policy of relative grading will be followed for awarding final grades.

III. Attendance Policy

Students should attend all tutorial and discussion sessions of the course over Zoom.

IV. Makeup Examination Policy

There will be no makeup examinations for missed mid-semester examination or quizzes. If a student does not appear in the mid-semester examination or a quiz due to bonafide reasons, s/he may be considered for prorating. But, the instructor's decision will be final in this regard.
For missing the mid-semester examination or a quiz due to bonafide non-emergent situation, request for proration shall be made well before the date of mid-semester examination or quiz.
For missing the mid-semester examination or a quiz due to an emergent situation, request for proration shall be made as soon as possible after the date of mid-semester examination or quiz. In case of a medical emergency, the student must present a letter from the doctor stating that the student was not in a condition to take the examination/quiz.
Makeup examination for the end-semester examination will be as per the institute policy.