

DS 221-Inferential Statistics and Applied Probability	CS
<b>Pre-Requisite:</b> Nil <b>Instructor:</b> <b>Muhammad Sajid Ali</b> Office # S-23, Second floor, NAB, GIK Institute. Email: <a href="mailto:sajid.ali@giki.edu.pk">sajid.ali@giki.edu.pk</a> Office Hours: 10:00am ~ 01:00 pm	

Course Introduction
<p>The first part of course focuses on theoretical and mathematically formal framework for applied probability and probability distributions for discrete and continuous random variables. The second part focuses on Statistical inference, which is the process of using data analysis to draw conclusions about a population or process beyond the existing data. Inferential statistical analysis infers properties of a population by testing hypotheses and deriving estimates. Students in this course will learn, the principles underlying statistical methods including sample vs population; how to implement inferential tasks including testing, estimation, confidence intervals; model selection and how to use models based on a few specific distributions, such as normal, binomial, Poisson.</p>

Course Contents
<ul style="list-style-type: none"> <li>• Various descriptive statistics (mean, standard deviation, variance) and visualization methods for 1D datasets, Scatter plots, correlation, covariance standard co-ordinate's and prediction for 2D datasets.</li> <li>• Discrete probability, Conditional probability, with a particular emphasis on examples, Random variables and expectations, probability density functions and how to interpret them) Markov's inequality, Chebyshev's inequality, and the weak law of large numbers.</li> <li>• Samples and populations, Confidence intervals for sampled estimates of population means, Statistical significance, including t-tests, F-tests, and chi-square-tests, one-way and two-way experiments, ANOVA for experiments , Maximum likelihood inference,</li> <li>• Methods for Regression and Classification</li> </ul>

Mapping of CLOs and PLOs			
Sr. No	Course Learning Outcomes <sup>+</sup>	PLOs*	Blooms Taxonomy
CLO_1	Understand the basic concepts of probability, including the axioms of probability, conditional probability, and independence.	PLO 1	C1 (Knowledge)
CLO_2	Be able to analyze data, including basic descriptive statistics, and probability distributions and to use statistical software for graphical description .	PLO 1	C3 (Application)
CLO_3	Understand the basic concepts of statistical inference, including estimation, hypothesis testing, and confidence intervals along with interpretation of linear regression analysis and assess the goodness of fit.	PLO 1	C3 (Application)
	*Please add the prefix "Upon successful completion of this course, the student will be able to"		

CLO Assessment Mechanism			
Assessment tools	CLO_1	CLO_2	CLO_3
Quizzes	35%	15%	25%
Assignments	35%	15%	25%
Project			
Midterm Exam	30%	50%	
Final Exam		20%	50%

Overall Grading Policy		
Assessment Items	Percentage	
Quizzes	15%	

Assignments/Project	15%	
Midterm Exam	25%	
Final Exam	45%	
<b>Text and Reference Books</b>		
<b>Textbooks:</b> David Forsyth - Probability and Statistics for Computer Science-Springer Michael Baron - Probability and Statistics for Computer Scientists, 2 <sup>nd</sup> Edition, Chapman and Hall CRC  <b>Reference books:</b> <ul style="list-style-type: none"> <li>Jay L. Devore - Probability and Statistics for Engineering and the Sciences-Cengage Learning (2015)</li> </ul>		
<b>Administrative Instruction</b>		
<ul style="list-style-type: none"> <li>According to institute policy, “Students are required to attend 100% classes of courses registered and cannot abstain from even a single class. For circumstances beyond their control, students must apply for leave on the prescribed leave application form”.</li> <li>Assignments must be submitted as per instructions mentioned in the assignments.</li> <li>In any case, there will be no retake of (scheduled/surprise) quizzes.</li> <li>For queries, kindly follow the office hours in order to avoid any inconvenience.</li> </ul>		
<b>Computer Usage</b>		
<ul style="list-style-type: none"> <li>Some of the assignment will be simulation based</li> </ul>		
<b>Lecture Breakdown</b>		
<ul style="list-style-type: none"> <li>Week 01. Introduction</li> <li>Week 02 Tools for looking at data, Datasets</li> <li>Week 03. Summarizing 1D data</li> <li>Week 04. Summarizing 1D data</li> <li>Week 05. Plots and summaries</li> <li>Week 06. Looking at relationships</li> <li>Week 07. Basics of probability</li> <li>Week 08. Random variables and expectations</li> <li>Week 09. Useful probability distributions</li> <li>Week 10. Samples and Populations</li> <li>Week 11. Confidence Intervals</li> <li>Week 12. Significance of Evidence</li> <li>Week 13. Significance of Evidence</li> <li>Week 14. Inferring probability models</li> <li>Week 15. Inferring probability models</li> </ul>		