National University

Of Computer & Emerging Sciences
Karachi Campus

Course Outlines of BS (CS) Degree Program

Course Instructor	Mr. Osama Bin Ajaz, Dr. Fahad Riaz, Muhammad Amjad, Jamil Ahmed	Semester	Spring 2022
Batch/Section(s)	Batch 2020	Year	2022
Course Title	MT2005-Probability and Statistics	Credit Hours	3
Prerequisite(s)	Calculus 1 & 2	Course TA	

Text Book(s)

Title of book	Probability & Statistics for Engineers & Scientists, 9th Edition
Author(s)	Walpole, Myers, Myers YE

Reference Book(s)

1-Probability And Statistics For Engineering And The Sciences, Jay L Devore 8ᵗʰ Edition

2-Introductory statistics , Neil A.Weiss , 9ʳᵈ Edition

Course Objective:
The course is designed to: • Develop the understanding of probability, random variables and random processes • To be proficient at manipulating data to draw insights and probe research questions. • Enhance the capabilities of data interpretation. • Develop the necessary software skills like EXCELL,MINITAB, SPSS

Course Description:
Ideas and tools based on probability, statistics and data analysis are becoming increasingly important in computer science research. In areas such as artificial intelligence and theory, probabilistic methods and ideas based on randomization are central, and in other areas such as networks and systems they are becoming increasingly useful. Research that involves manipulating large data sets is also becoming common, and in all areas of computer science statistical techniques are important in the design and analysis of experimental work. This course gives an introduction to probability and data analysis from a computer science perspective, including many of the fundamental concepts and techniques that are most relevant to current research areas. The course will put an emphasis on computing. Research in CS is fast-paced, and researchers often need to be proficient at manipulating data to draw insights and probe research questions. The course will make use of three general scientific computing environments to help and develop the necessary skills: Matlab, R, and SPSS. It will include the rudiments of probability and random variables, estimation, special distributions and sampling, hypothesis testing and regression analysis.

Tentative Weekly Lectures Schedule:

Week	Theory Contents/Topics	Sections	CLO	Tools
1	**Descriptive statistics :** Basic definition , Types of variables ,Mean, Median, Mode, Variance,Standard Deviation, Quartiles, Deciles, Percentiles, IQRange	WP [1.1, 1.3, 1.4, 1.6] & NW [2.1 – 2.4, 3.1 – 3.4]	1	A1, M1, F
2	**Graphical representation of data** : Construction of bar chart , histograms, Stem-leaf plots,box plot,ogive,frequency curve, Skewnwss and Kurtosis.	WP [1.3, 1.6] & NW [2.2 – 2.4]	1	
3	**Sample Space and Event:** Sample point,tree diagram,set theory ,venn diagram	WP [2.1 – 2.3]	1	
4	Counting techniques, Probability of an event, Additive rules	WP [2.4 – 2.5]	1	
5	**Axioms of Probability:** Conditional Probability, Independence and Multiplicative rules.Bayes' Rules	WP [2.6 – 2.7]	2	
6	**1ˢᵗ Mid Term Exam**			
7	**Random Variables & Probability Distributions:** Concept of random variable (CLO-I), **Discrete Probability Distribution**, PMF, CDF, joint probability distribution, marginal distribution	WP [3.1-3.2, 3.4]	1, 2	
8	**Continuous Probability Distributions** PDF and CDF Joint Probability Distribution, marginal distribution (CLO-2)	WP [3.3, 3.4]	2	A2, M2, F
9	**Mathematical Expectations:** Mean & Variance of a Random Variable, Covarriance, and Correlation (CLO-2)	WP [4.1, 4.2]	2	
10	Binomial, Poisson, Normal and standard normal distributions and applications (CLO-2)	WP [5.1, 5.2, 5.5, 6.2 – 6.4]	2	
11	**2ⁿᵈ Mid Term Exam**			
12	**Estimation & Hypothesis Testing:** Introduction, confidence interval estimation using z & t distributions for single mean and difference between two means,Testing of hypothesis for single mean and difference between two means using z-test (CLO-3), p-value method (CLO-3)	WP [9.1 – 9.5, 9.8, 10.1 – 10.5]	2, 3	
12	**Independent & Dependent sample tests:**	WP [9.1 –	3	A3, F

	One-sample t-test, independent and depenent sample t-tests, confidence intervals (CLO-3)	9.5, 9.8, 10.1 – 10.5]		
14	**Regression & Correlation:** Scattered diagram (CLO-2) .Introduction to linear regression. The simple linear regression model (CLO-3), Simple Correlation (CLO-2), coefficient of determination (CLO-2)	WP [11.1 – 11.3. 11.12]	2, 3	
15	**Multiple linear Regression :** Multiple regression (CLO-3) and correlation (CLO-2) , coefficient of determination (CLO-2), assumptions (CLO-2)	WP [12.1 – 12.2]	2, 3	
16	**Analysis of variance:** ANOVA (CLO-3)	WP [13.1, 13.2]	3	
17	**Final Exam**			

Particulars	Marks Distribution (%)
Mid-I	15
Mid-II	15
Final	50
Assignments / Quizzes	20
Total	100

MT205 Probability & Statistics				
Credit Hours:	3 (3, 0)	**Prerequisites:**	Calculus I	
Course Learning Outcomes (CLOs):				
At the end of the course the students will be able to:	**Domain**	**BT Level***	**PLO**	
1. **Describe** the fundamental concepts in Probability and Statistics	Cognitive	2	2	
2. **Analyze** the data and produce probabilistic models for different problems	Cognitive	4	2	
3. **Apply** the rules and algorithms of Probability & Statistics to their relevant problems.	Cognitive	3	2	

*BT = Bloom's Taxonomy

Relevant PLO	
2. Problem Analysis	Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.