COURSE OUTLINE

STATISTICAL INFERENCE

Class	BBA-3
Course	MTS 202- Statistical Inference
Class #	7311&7323 (MAC-7), 7293 (MAC-4)
Instructor	Dr. Amir Bashir

Class details	
Session Day(s)	Mon/ Wed (10:00 – 11:15) (7293), Tue/Thu (11:30 - 12:45) (7311,7323)
Credit Hours	3 Credit Hours
Email	abashir@iba.edu.pk
Counseling Hours	Monday & Wednesday (2:00 – 03:30) p.m.
Office Location	Room 228, Tabba Block (2nd Floor South Wing), Ext 3081.

Course Description
This second course in Statistics aims at enhancing students' understanding and competency in carrying out quantitative analysis in business, economics, social sciences, and computer science. The course covers areas such as sampling and sampling distributions, point and interval estimation, and tests of hypotheses based on critical and p-value approaches. The parameters of interest are one and two population means, variances, proportions, correlation, and regression parameters, etc. The purpose of inferential statistics is to test, deduce and infer the validity of different types of hypotheses and models built on the basis of the raw data collected in diverse problem situations.

BBA Program Learning Goals
1. Communication Skills Students will become effective speakers, listeners, writers, and team members.
2. Knowledge of All Business Disciplines Students will gain a broad-based understanding of a range of business disciplines.
3. Critical Thinking Students will develop the ability to classify, analyze and evaluate the available data using appropriate techniques for effective decision making.
4. Ethics Students will have an awareness and understanding of ethical issues.
5. Global Mindset Students will develop a focus on global connections with local contexts through awareness of diversity across cultures and markets.

Course Learning Outcomes (CLOs)
1. Understand concepts, methods, and use of sampling distribution of sample mean and proportion. (PLO 302) 2. Compute and interpret interval estimates and conduct hypothesis tests of means, proportions and variance to assess statistical and practical significance. (PLO 302) 3. Estimate and use simple and multiple regression to determine significance of relationship between one or more variables in business context. (PLO 302) 4. Estimate, interpret and use logistic regression in prediction and marginal effect computation. (PLO 302) 5. Compute and use decision trees for regression and classification in business applications. (PLO 302) 6. Analyze categorical data using chi-square tests of independence and goodness of fit. (PLO 302)

AOL Assessment Mapping
PLO mapped: The course is mapped with BBA/BSAF PLO 302 **Assessment Tool**: AOL assessment not applicable

Course Learning Outcomes mapped to Program Learning Outcomes					
Program Learning Goals	**Communication Skills**	**Knowledge of All Business Disciplines**	**Critical Thinking**	**Ethics**	**Global Mindset**
Course Learning Outcomes					
1			PLO302		
2			PLO302		
3			PLO302		
4			PLO302		
5			PLO302		
6			PLO302		

Textbook and Course Reading Material
Text and Reference Books: 1. **Anderson**, et al. (2020). Statistics for Business and Economics (14th Edition). South-Western Cengage Learning **(Main Text)** 2. Weiss (2017). Introductory Statistics. (10th or latest edition) Addison-Wesley. **(Weiss)** 3. Newbold, Calrson and Thorne (2023). Statistics for Business and Economics (10th Edition). Pearson. **(Newbold)** 4. Moore, McCabe and Craige (2021). Introduction to the Practice of Statistics. (10th Edition). WH Freeman and Company**. (Moore)**

5. Keller, Gerld (2018). Statistics for management and economics. 11th Cengage Learning. **(Keller)**

6. Walpole, Myers and Myers and Ye (2012) Probability and Statistics for Engineers and Scientists (9th Edition). Prentice Hall. **(Walpole)**

7. Bowerman, O'Connell, and Murphree (2017). Business statistics in practice: using data, modeling, and analytics **(Bowerman),** McGraw-Hill

8. Camm, Cochran, Fry, and Ohlmann (2021). Business Analytics. Cengage. **(Camm)**

Tentative Teaching Plan

S.No.	Topics	Chapter, Resources	Mapping to Course Learning Outcomes
1	1.Parameter and Statistic, Random Sampling. Sampling error. Branches of Statistics. Descriptive and predictive analytics. 2. Sampling distribution. Central Limit Theorem.	Weiss Ch7, Anderson Ch7, Camm Ch1	CL01
2	1. Computing probabilities using the CLT. 2. Sampling distribution of proportions.	Weiss Ch7, Anderson Ch7	CL01
3	1. Estimate, estimator, and estimation. Properties of good point estimator, Point estimation & interval estimation, confidence coefficient & level of significance. 2. Confidence interval for population mean when σ^2 is known	Weiss Ch8, Anderson Ch7, 8	CL02
4	1. Confidence interval for population mean when σ^2 is unknown 2. Recap of CLT, sampling distribution and CI	Weiss Ch8, Anderson Ch7, 8	CL02
5	1.Hypothesis, Null & Alternative Hypotheses, Simple & Composite Hypotheses, Level of Significance or Type-I Error, Type-II Error, Test Statistic, Critical Region, One-Tailed & Two-Tailed Tests, 2. P value approach to hypothesis testing	Weiss Ch9, Anderson Ch9	CL02
6	1. Hypothesis test for Population Mean when σ^2 is unknown 2. Confidence Interval for the Difference between Population Means when σ_1^2 and σ_2^2 are Known, When σ_1^2 and σ_2^2 are Unknown	Weiss Ch10, Anderson Ch10	CL02
7	1. Hypothesis tests for the difference between Population Means when σ_1^2 and σ_2^2 are Unknown 2. Hypothesis tests for difference between means for paired samples.	Weiss Ch10, Anderson Ch10	CL02
8	1. Simple Linear Regression, Parameter estimation via Least Square 2. Inference in regression. Correlation, its measurement and properties	Weiss Ch14, Anderson Ch14	CL03

9	1. Multiple Regression: prediction and model evaluation 2. Incorporating qualitative independent variables in regression	Weiss Module A & Ch16, Anderson Ch15	CL03
10	1. Logistic regression for binary dependent variable 2. Interpretation coefficients in terms of probability and odds ratio	Anderson Ch15	CL04
11	1. Analysis of residuals in regression 2. Using R for multiple and logistic regression	Anderson Ch15 Weiss Ch16, Anderson Ch15. R handouts	CL03 CL04
12	1. Regression and classification trees. Interpretation and prediction 2. Introduction to Analysis of Variance (One way ANOVA)	Weiss Ch16, Anderson Ch15, Camm Ch3	CL03
13	1. Chi-Square Test for Goodness-of-Fit 2. Chi-Square Test for Independence of Attributes	Weiss Ch13, Anderson Ch12	CL06
14	1. Confidence Interval for Population Proportion and Difference Between Population Proportions. 2. Testing of Hypotheses for Population Proportion and Difference Between Population Proportions.	Weiss Ch12, Weiss 12, Anderson Ch10	CL03

*. For BBA programs the title is 'Statistical Inference (with Econometrics Lab)'

**. Suggested to be conducted using software in computer lab for BBA

*Some sessions will be based on R software. Introduction to R will be provided in the course. Students can work on their projects using R/Python/Excel as per their instructors advise.

In addition, students can learn topics from a variety of sources books websites, courses of other universities etc. for example Penn State University has a nice course on Applied Statistics available at https://onlinecourses.science.psu.edu/stat500/node/

Prerequisite Skills and Knowledge to take this Course
Be comfortable with using technology for learning. **Software: Python/R/Excel**. **This course follows absolute grading. Terminal exam is cumulative i.e., based on entire course.**

Marks Distribution					
Marks Head	**Total Frequency**	**Total Exempted**	**Marks /Frequency**	**Total Marks /Head**	**Learning Outcomes**
Quizzes	5	1	2.5	10	CL01 through CL06
Assignment	1	0	10	10	CL02, CL03
Mid Term Exam	1	0	30	30	CL01, CL02
Final Exam	1	0	50	50	CL03 through CL06
Total Marks				**100**	

(1) There will be 5 quizzes and the 4 best will be counted. (2) Quizzes will be conducted in every 5th session.
(3) Due date of Assignment is 24th class of the semester.

Teaching and Innovation
- LMS/Sakai will be used to share reading material with the students. Grades will be posted on ERP. - Demonstration of R software will be done in the class. - Students should bring the calculator & textbook in the class. - For discussions and course related queries please join the class WhatsApp group.

Experiential Learning Exposure(s)
• Group project on collection of real data from listed companies and economy and statistical analysis including graphs plots, hypothesis tests and regression using software

Social Contribution / Impact
• Inculcating among the students an awareness of importance of real data and appropriate ways for their analysis

Academic Conduct
IBA policy
Attendance Policy
IBA policy
Plagiarism Policy
IBA policy
Withdrawal Policy
IBA policy