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**Department of Mathematics**

**College of Basic Education**

**Salahaddin University- Erbil**

**Subject: Statistical Inference**

**Course Book –4th stage – first semester**

**Lecturer's name: MS. Zhyan R. Ali**

**Academic Year: 2022/2023**

**Course Book**

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| **1. Course name** | Statistical Inference |
| **2. Lecturer in charge** | Ms. Zhyan R. Ali |
| **3. Department/ College** | Mathematics/ Basic Education |
| **4. Contact** | e-mail :zhyan.ali@su.edu.krdTel: () |
| **5. Time (in hours) per week**  | Theory: 4 |
| **6. Office hours** | 4 hours in week |
| **7. Course code** |  |
| **8. Teacher's academic profile**  | 1) B.Sc. in Mathematic. Mathematic Department- College of Education- Salahaddin University- Erbil in 1997.2) M.Sc. in Mathematic. Mathematic Department- College of Science - Salahaddin University- Erbil in 2010. |
| **9. Keywords** | Statistical Inference, Parametric, Independent random variable, Order Statistics, estimation. |
| 10. Course overview: Statistical inference 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. For example, you might survey a representation of people in a region and, using statistical principles including simulation and probability theory, make certain inferences based on that sample. In this course, you will explore modern statistical concepts and procedures derived from a mathematical framework. This course is designed for advanced undergraduates, Masters students in statistics, and Doctoral students in STEM and other programs. You will develop a deep understanding of how statistics works which will prepare you for additional coursework in statistics. Assignments may require some computation in R programming language.This course gives an introduction to the fundamental theory in statistical inference. The knowledge taught in this course is fundamental in statistical inference and necessary to carry out decent statistical research. The prerequisites are a basic knowledge of probability, statistics and mathematics (Stage 2, basically). It comprises the topics in discrete and continuous random variables, multivariate distributions, sampling theory for the normal distribution, parametric estimation, hypothesis testing, and linear regression models. It is a statistical theory paper. It is important that a student is able to use both calculus and linear algebra confidently in order to cope with this paper.The principles underlying statistical methods including sample vs population. How to implement inferential tasks including testing, estimation, confidence intervals, and model selection. How to use models based on a few specific distributions, such as normal, binomial, Poisson.  |
| **11. Course objective:**This course is intended to provide students with an understanding of the theory of statistical inference, including point and interval estimation, hypothesis testing, as well as the assessments of the procedures. By the end of the course, students are expected to be able to identify the estimators for quantities of interest, and optimal tests for hypotheses.  |
| **12. Student's obligation** Student readiness is very important to learn and get note about the lesson, because you are amenable to the lesson. |
| **13. Forms of teaching**White board and Data show to view the headlines, definitions and figures |
| **14. Assessment scheme**Test 1 = 20Test 2 = 20the total = 40 and final exam =60 |
| **15. Student learning outcome**:By the end of this course, students will be able to:1. Demonstrate an understanding of discrete and continuous random variables.
2. Develop and demonstrate the knowledge of using calculus to derive formulae for distributions.
3. Understand and analyse multivariate distributions.
4. Understand and analyse the sampling theory for the normal distribution.
5. Learn and use the theory for parameter estimation and find and carry out a likelihood analysis.
6. Learn and use the formula for hypothesis testing.
7. Learn and use the theory for linear regression and the associated geometry.
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| **16. Course Reading List and References‌:****Main References**:* Statistical Inference

د.ظافر حسين رشيدد.عبدالمجيد حمزة* Introduction to Mathematical Statistics ,By Hogg and Craig
* Introduction to Probability Theory and Statistical Inference , By Harold j.Larson
* أمير حنا هرمز الإحصاء الرياضى

**Secondary References** * **Alan Agresti, ((Statistical methods for the social sciences)), third edition**
* **Jay L. Devore ((Probability and Statistics)) sixth edition**
* **محمد صبحي ابو صالح (( مبادىء الاخصاء)) 2007، جامعة اليرموك**
* **خاشع محمود الراوي ((المدخل الى الاحصاء)) ،2000 ، جامعة الموصل**
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| **17. subject** |  |
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| **subject**  | **Week** |
| Introduction to Statistical Inference. | 1 |
| Some definition of statistic Inference Some Parametric distribution.Independent random variable.Transformation of variable. | 2 |
| Order Statistics. Example | 3 |
| Independent random variable of Order Statistics. | 4 |
| Method of estimator, Properties of point estimator(Unbiasedness, Mean squired error, | 5 |
| Efficiency, Consistency, Sufficiency, Exponential Family. | 6 |
| Rao-Black well theorem, Completeness of estimator | 7 |
| Fisher Information, : Cramer-Rao Inequality | 8 |
| Confidence Interval estimator for mean µ. Confidence Interval estimator for variance δ2 . | 9 |
| statistical Hypotheses. | 10 |

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| **18. Practical Topics (If there is any)** |  |
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| **19. Examinations:** Q1: let x,y be two cont. r.v. having joint p.d.f. defined by 1) find the marginal of x , y respectively.2) find the conditional p.d.f. of h1(x/y), h2(y/x).3) find E(x/y) and Var(x/y). Q2: let find p.d.f of Q3: let x and y be two independent random variables that have Gamma distribution with parameters (α,1) and (β,1) respectively find j.p.d.f. of .Q4: let x have uniform distribution on find the p.d.f. of .Q5: 1) let be the order statistics if identical independent distribution (iid) random variable with p.d.f. show that are independent.2) let be random sample from the distribution which have p.d.f.let 1) find the limiting distribution of .2) find the limiting distribution of . Q6: let be order statistics of size n of uniform f(x,θ) distribution, let t(x)=max() be an estimator for t(θ) show t(x) unbiased estimator for θ?Q7:- let be a r.s.s.n. from N(θ,S2) and letbe an estimator for show it is unbiased or not?  |
| **20. Extra notes:** |
| **21. Peer reviewپێداچوونه‌وه‌ی هاوه‌ڵ** Dr.Dler M. K. |