

KURDISTAN REGIONAL GOVERNMENT  
MINISTRY OF HIGHER EDUCATION & SCIENTIFIC RESEARCH  
SALAHADDINUNIVERSITY – HAWLER (SUH)  
COLLEGE OF ADMINISTRATION AND ECONOMICS.  
STATISTICS DEPARTMENT

***Syllabus of***  
***Mathematical Statistics***  
***Undergraduate Students***  
***2023 – 2024***

***Prepared by***  
***Dr. Dler Hussein Kadir***  
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## Mathematical Statistics

### **Course Objectives**

**First:** Knowing data, they are continuous or discrete.

**Second:** Learning how to find medium and variance for statistics function (discrete or continuous).

**Third:** Learning some fundamental rules in Mathematical Statistics and knowing where and how they are used.

**Fourth:** knowing the time using distribution and knowing which data are suited with them.

**Fifth:** Learning useful information in transforming data so in the fourth stage ,at the beginning will get full familiarity with connected topic which is **Statistical Inference** (the basic subject in Fourth stage)

***College of Administration & Economics***

***Department of Statistics***

***Third Stage***

## Course book

Mathematical Statistics

**Instructor:** [Dr.Dler Hussein Kadir](#)

**Email:** [math3stat@gmail.com](mailto:math3stat@gmail.com); be sure to put "**math-stat**" at the beginning of the subject line, or I might miss it.

**Office Hours:** Monday. 10:00-10:30 Wednesday. 10:00-10:30

**Grading:** Grades will be assigned on a curve, using the following percentages: **5%** Report, **10%** Quizzes, **25%** Exams, **60%** Final and Pass : **50%**.

***No makeup Exams or quizzes will be given.***

We'll drop the lowest quiz score (**out of about three quizzes**).

**Final exam:** Classes end officially on the second week of May; so we'll have an optional review class on the last week of May 2021,

Level: Bachelor of Science; Stage 3<sup>rd</sup> Statistics Department.

## **Course Overview**

Mathematical Statistical is considered a topic in department of statistics, because at the beginning the student will get familiar with statistical distribution most of the researches are depending on this distribution for analyzing data.

-Via statistics students will learn proving any rules and how they formed, we will make students learn them especially according to their distributions.

-How medium Variance, Moments, covariance for each function is found in different researches.

-How using Mathematical statistics in proper time according to discrete and continuous is found, and which of them is suited (fitted) with that distribution, so that we'll be able to find medium and variance.

## *Course outline*

<b>Date</b>	<b>Topics</b>	<b>Notes</b>
<b>Chapter ONE</b> <b>Mathematical Expectation &amp; Moment</b>		
Fifth week	- Mathematical Expectation	
Sixth week	- Moment (Non – Central & Central) - Coefficient of Skewnes	
Seventh week	- Coefficient of Kurtosis - Cheby Shev's Inequality	
Eighth week	- The Moment Generating Function	
<b>Chapter Two</b> <b>Joint &amp; Conditional Probability</b>		
Ninth week	- Joint Probability Density Function - Joint Probability Mass Function - Joint Cumulative Distribution Function	
Tenth week	- Marginal Probability Distribution Function - Expectation Joint Mathematical Function	
Eleventh week	- Covariance & Correlation Coefficient - Joint moment generation function	
Twelfth week	- Stochastic Independence	
Thirteenth week	- Conditional Probability Distribution Function	

Date	Topics	Notes
	- Conditional Probability Cumulative Distribution	
Fourteenth week	- Conditional Expectation & Variance	
Chapter Three Transformation		
Twenty-fourth week	- Transformation of Discrete type	
Twenty-fifth week	- Transformation of Continuous type	
Twenty-sixth week	- Order Statistics	
Twenty-seventh week	- Univariate Probability distribution function	
Twenty-eighth week	- Sample Median	
Twenty-nine week	- Bivariate p.d.f	
Thirteenth week	- Exam and Review of year	

*The most important thing that the students should keep the subject under control, we should take this point into consideration.*

1. The important of integration in the first stage, students should review the basic rules.
2. Memorizing or recognizing statistical rules which are (26) basic rules that we always take them into consideration.
3. Students should make a connection between the previous subject and current one.

4. While displaying important points students should write them down because these notes are crucial for solving the questions.
5. Following up those questions that are left unsolved students should do their best to solve them.

**References:**

- 1- [Introduction to Mathematical Statistics](#), 6th Ed 2004. by Hogg, McKean, and Craig.
- 2- [Mathematical Statistics](#), 2<sup>nd</sup> Ed 2003, by Jun Shao,
- 3- [Introduction to Mathematical Statistics](#), 3<sup>rd</sup> Ed 1970. by Hogg, McKean, and Craig.
- 4- [Introduction to Mathematical Statistics](#), 4<sup>th</sup> Ed 1983. by Hogg, McKean, and Craig.

## Same Laws about the Statistical Parameters

$$1 - (e^{-\infty} = 0), (e^{\infty} = \infty), (e^0 = 1), ((\infty)^{\#} = \infty), ((\infty)^{-\#} = 0), \left(\frac{1}{\infty} = 0\right)$$

$$2 - \sum_{x=0}^{\infty} r^x = 1 + r + r^2 + r^3 + \dots = \frac{1}{1-r}, 0 < r < 1, \text{ Where } r \text{ is constant}$$

$$3 - \sum_{x=1}^{\infty} r^x = r + r^2 + r^3 + \dots = \frac{r}{1-r}, 0 < r < 1$$

$$4 - \sum_{x=n}^{\infty} r^x = r^n + r^{n+1} + r^{n+2} + \dots = \frac{r^n}{1-r}, 0 < r < 1$$

$$5 - \sum_{x=0}^n r^x = 1 + r + r^2 + \dots = \frac{1-r^{n+1}}{1-r}, 0 < r < 1$$

$$6 - \sum_{x=1}^n r^x = r + r^2 + \dots = \frac{r(1-r^n)}{1-r}, 0 < r < 1$$

$$7 - \sum_{x=1}^n r = nr \quad \text{Where } r \text{ is constant}$$

$$8 - \sum_{x=m}^n r = r(n-m+1) \quad \text{Where } m \text{ is a real number}$$

$$9 - \sum_{x=1}^n x = \frac{n(n+1)}{2} \quad \& \quad \sum_{x=1}^n x^3 = \left(\frac{n(n+1)}{2}\right)^2$$

$$10 - \sum_{x=1}^n x^2 = \frac{n(n+1)(2n+1)}{6}$$



$$11 - \sum_{x=0}^n C_x^n a^x b^{n-x} = (a+b)^n$$

$$12 - \sum_{x=0}^{\infty} \frac{r^x}{x!} = e^r$$

$$13 - \sum_{x=0}^{\infty} C_{k-1}^{x+k-1} r^x = \left(\frac{1}{1-r}\right)^k$$

$$13 - \sum_{x=0}^{\infty} C_{k-1}^{x+k-1} r^x = \left(\frac{1}{1-r}\right)^k$$

$$14 - \sum_{x=0}^k C_x^n C_{k-x}^m = C_k^{n+m}, \quad \sum_{x=0}^k C_x^n C_{k-x}^n = C_k^n$$

$$15 - \int_{-\infty}^{\infty} e^{-\frac{1}{2}\left(\frac{z-m}{\sigma}\right)^2} dx = \sqrt{2\pi} \quad -\infty < x < \infty, \quad z > 0$$

$$16 - \int_0^{\infty} x^{r-1} e^{-x} dx = \overline{)r} \quad \text{Where } \overline{)r} = (r-1)!$$

$$17 - \int_0^{\infty} x^{r-1} e^{-Bx} dx = \frac{\overline{)r}}{B^r}$$

$$18 - \int_0^{\infty} x^{r-1} e^{-x/B} dx = \overline{)r} B^r \quad r, B > 0$$

$$19 - \int_0^1 x^{a-1} (1-x)^{b-1} dx = \frac{\overline{)a} \overline{)b}}{\overline{)a+b}}$$

$$20 - \overline{) \frac{1}{2}} = \sqrt{\pi}$$

$$21 - \ln(1-x) = -x - \frac{x^2}{2} - \frac{x^3}{3} - \dots$$

22 – The Permutation of tossing [for coin (n) times is  $S=2^n$ ] & [for the affair dice is  $S=6^n$ ]

$$23 - (1-x)^{-1} = \sum_{k=0}^{\infty} x^k = 1 + x + x^2 + x^3 + \dots$$

$$24 - (1-x)^{-2} = \sum_{k=0}^{\infty} (k+1)x^k = 1 + 2x + 3x^2 + 4x^3 + \dots$$

$$25 - \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(z)^2} dz = 1$$

$$26 \quad C_x^{x+r-1} = (-1)^x C_x^{-r} \quad C_r^x = C_{x-r}^x$$

## Teacher's academic profile

### Job experience

- (2010-2011) Director in Ministry of Higher Education & Scientific Research (Directory of Quality Control).
- (2008-2009) Director in Ministry of Higher Education & Scientific Research (Directory of Evaluations) .
- (2007-2011) Lecturer (in College of Administration & Economics- Department of Statistics.

### Teaching Experience

- (2002-2005) Giving practical lectures College of Administration & Economics in the department of statistics in.
- (2007-2011) Lectured third class mathematical statistics.
- (2008) Lectured (second year student) Microsoft Access Program.
- (2008) Lectured (second year student) Microsoft Excel Program.
- (2008) giving lectures to (the first year student) College of Administration & Economics in the integration and differentiation.
- (2010) giving lectures in Technical Institute in Shaqlawa ( First Course: Principle of Statistics, Second Course: FinancialMath)
- (2017-2018) giving lectures at Cihan Univesity-Erbil ( First Course: Principle of Statistics, Second Course: Applied Statistics)

### Academic Achievements

- (2013- 2018) PhD ([Bayesian Inference of Autoregressive Models](#) ) University of Sheffield.
- (2005-2007) MSc Degree in ([Application of Bayesian Technique For Ala Pepsi Soft Drinks Company in Sampling Plan Design](#)) in statistics.
- Evaluation: Very good again I was first student among my colleagues.
- (1999-2002) BSc. statistics in Salahaddin University College of Administration & Economics.
- Evaluation: Excellent & I was first on the university (Scientific Departments).