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| Department of | **Biology** |
| College of | **Education** |
| University | **Salahaddin– Erbil** |
| Subject | **Biostatistics****(Theory Part)** |
| Course Book | **2nd Class Students** |
| Lecturer's name | Assist. Prof. Dr. **Rebwar M. Hama Salih****PhD. Degree** |
| Academic Year | **2022 – 2023** |

**Course Book**

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| 1. Course name | Biostatistics |
| 2. Lecturer in charge | Assist. Prof. Dr. **Rebwar M. Hama Salih** |
| 3. Department/ College | **Biology, Education** |
| 4. Contact | **e-mail:** rebwar.hamasalih@su.edu.krd**Tel: (**07512686561**)** |
| 5. Time (in hours) per week  | **Theory: 4 hours****Practical: 0** |
| 6. Office hours | **10 hours per week** |
| 7. Course code | **EDB2205** |
| 8. Teacher's academic profilePersonal InformationName: Rebwar M. Hama SalihTitle (Positions): PhD. degree in Molecular BiologyDepartment: BiologyCurrent Academic Rank: Assist. ProfessorPeriod in Current Academic Rank: 3 yearsGender: MalePrevious Academic Position: Department of Biology, College of Education, Salahaddin University – Erbil, Assistant Biologist., 18 years.Primary Academic/Practice Discipline: Department of Biology, College of Education, Salahaddin University – Erbil, Lecturer, 1 years.Degrees and Other CredentialsDegrees Awarded

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| **No** | **Degree** | **Institution** | **Year** |
| **1.** | B.Sc in General Biology | Department of Biology, College of Education, Salahaddin University, in Erbil, Iraq | July 24, 2003 |
| **2.** | Master in Medical Microbiology | Department of Biology, College of Education, Salahaddin University, in Erbil, Iraq | February 9, 2009 |
| **3.** | PhD. in Molecular Biology | Department of Biology, College of Education, Salahaddin University, in Erbil, Iraq | May 19, 2020 |

Employment History

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| **No.** | **Employments** | **Year - Year** |
| **1.** | Date of first assignment: Demonstrator. Biology Dept., Education College, Salahaddin University – Erbil, Iraq. | November 3, 2003 |
| **2.** | Assist. Lecturer | May 22, 2010 |
| **3.** | Member in the Examination Committee of the College of Education. | 2010-2015 |
| **4.** | Member in Quality insurance committee of Biology Dept. | 2011-2014 |
| **5.** | Decider of Biology Department, Education College, Salahaddin University. | 2013-2014 |
| **6.** | Lecturer | October 21, 2015 |
| **7.** | Assistant Professor | December 20, 2020 |

Advising Experience

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| **No.** | **Experience** | **Year - Year** |
| **1.** | Lecturer in Course on **Microbiology Lab** (Undergraduate study). | 2009 – Now |
| **2.** | Lecturer in Course on **Phycology** and **Archegoniate** **Lab** (Undergraduate study). | 2009 – 2010 |
| **3.** | Lecturer, First Semester, in Course on **Pathogenic** **Bacteria** **Lab** (Undergraduate study). | 2009 – 2011 |
| **4.** | Lecturer in Course on **Ecology** **and** **Pollution** **Lab** (Undergraduate study). | 2010 – 2011 |
| **5.** | Lecturer, First Semester, in Course on **Immunology** **Lab** (Undergraduate study). | 2011 – 2012 |
| **6.** | Lecturer in Course on **Biostatistics** (Undergraduate study). | 2012 – Now |

Research, Scholarly, Professional and Scientific Activity1. Rebwar M.H.S. Hallabjaiy, Suhaila N.R. Darogha Pishtiwan A. Hamad. (2014). Vancomycin Resistance among Methicillin Resistant *Staphylococcus* *aureus* Isolated from Clinical Samples in Erbil City-Iraq. *MEDICAL JOURNAL OF ISLAMIC WORLD ACADEMY OF SCIENCE*, 22(4): 168-174.
2. Rebwar M. Hama Salih, Khadija Khalil Mustafa and Zirak F. A. Abdulrahman. (2014). Anti-biotype of Different Bacteria Isolated from Different Clinical Sources. *INTERNATIONAL JOURNAL OF ENHANCED RESEARCH IN SCIENCE TECHNOLOGY ANND ENGINEERING, 3 (7):392-399, Impact Factor: 1.252.*
3. Rebwar M. Hama Salih and Adel K. Kheder. (2009). Effects of Both Aqueous and Alcoholic Extracts of *Quercus* *infectoria* against Antibiotic Resistance *Pseudomonas* *aeruginosa*: *In* *vitro* and *in* *vivo* Study. *ZANKO JOURNAL OF PURE AND APPLIED SCIENCE,* 3 (2): 89-99.
4. Hêro F.S. Akrayi, Rebwar M.H. Salihand Pishtiwan A. Hamad. (2015). *In* *Vitro* Screening of Antibacterial Properties of *Rhus* *coriaria* and *Origanum* *vulgare* against Some Pathogenic Bacteria. *ARO THE SCIENTIFIC JOURNAL OF KOYA UNIVERSITY*, 3 (2): 35-41.
5. Suhaila N. Darogha, Rebwar M. Hama Salih and Mahmoud K. Nuri. (2013). Antimicrobial Resistant Patterns of Bacterial Isolates from Patients Attending Erbil Hospitals. *4TH INTERNATIONAL CONFERENCE AND WORKSHOP ON BASIC AND APPLIED SCIENCE, AND 11TH REGIONAL ANNUAL FUNDAMENTAL SCIENCE SYMPOSIUM 2013 (ICOWOBAS-RAFSS 2013)*. UTM (UNIVERSITI TEKNOLOGI MALAYSIA), Johor, Malaysia.
6. Rebwar M.H.S. Hallabjaiy, Suhaila N.R. Darogha Pishtiwan A. Hamad. (2016). Vancomycin Resistance among Methicillin Resistant *Staphylococcus* *aureus* Isolated from Clinical Samples in Erbil City-Iraq. *KIRKUK UNIVERSITY JOURNAL/ SCIENTIFIC STUDIES (KUJSS)*, acceptant letter.
7. Rebwar M. Hama Salih, Khadija Khalil Mustafa and Zirak F. A. Abdulrahman. (2015). Anti-biotype of Different Bacteria Isolated from Different Clinical Sources. *TIKRIT JOURNAL OF PURE SCIENCE*, 21 (1): 21-30.
8. Rebwar M. Hama Salih and Zirak F. A. Abdulrahman. (2019). ANTIBIOFILM POTENCY OF GINGER (*ZINGIBER* *OFFICINALE*) AND QUERCETIN AGAINST *STAPHYLOCOCCUS* *AUREUS* ISOLATED FROM URINARY TRACT CATHETERIZED PATIENTS. *APPLIED ECOLOGY AND ENVIRONMENTAL RESEARCH,* 18 (1): 219-236.
9. Rebwar M. Hama Salih and Zirak F. A. Abdulrahman. (2020). Prevalence and diversity of virulence genes among *Staphylococcus* *aureus* isolated from urinary tract catheterized patients. *BIOCHEMICAL AND CELLULAR ARCHIVES,* 20 (1): 213-225.

Scientific meeting4th International Conference and Workshop on Basic and Applied Science, and 11th Regional Annual Fundamental Science Symposium 2013 (ICOWOBAS-RAFSS 2013), 3-5 September 2013 |
| 9. Keywords |  |
| 10. Course overviewTo get the facts about undergraduate and graduate statistics courses in a variety of fields. Take a look at course descriptions and common requirements, and find out what kinds of programs include training in statistics.Statistics courses are frequently offered through certificate, associate's degree, bachelor's degree and master's degree programs in statistics, mathematics, business administration and numerous physical and social science disciplines. Standalone statistics courses are widely available in on-campus and online formats as well; some lead to college credit, while others are offered on a non-credit basis for free. In general, students use statistical models to analyse and interpret data, and they may participate in lab training sessions or research projects. Some statistics classes are specific to an individual discipline, and others cover general statistics.Students often start their studies with an elementary statistics course. These courses cover probability, frequency distributions, graphing and correlations. Other concepts covered may include measures of location and variation, joint and marginal probabilities and regression. Students who take this course are often majoring in social, behavioural and physical sciences. Graduate students embarking on research projects may also take a course in elementary statistics.Biostatistics, which is an advanced class, involves the analysis of data from biology experiments. Students use regression, frequency distributions and variations in their analyses. Instead of just studying statistical theory, students are encouraged to analyse the data they gather while completing experiments. |
| 11. Course objectiveIn addition to specific learning outcomes, the course aims to shape the attitudes of learners regarding the field of Statistics. Specifically, the course aims to1. Motivate in students an intrinsic interest in statistical thinking.
2. Instill the belief that Statistics is important for scientific research.
3. Provide a foundation and motivation for exposure to statistical ideas subsequent to the course.

Each numbered item states a learning aim for the course, and the items that follow indicate the learning outcomes (or objectives) through which that aim could be deemed to have been satisfied.1. Demonstrate the ability to apply fundamental concepts in exploratory data analysis.1. Distinguish between different types of data.
2. Interpret examples of methods for summarizing data sets, including common graphical tools (such as boxplots, histograms and stemplots) and summary statistics (such as mean, median, mode, variance and IQR).
3. Identify the features that describe a data distribution.

2. Design studies for obtaining data whilst avoiding common design flaws that incur bias, inefficiency and confounding.1. Recognize observational studies and experiments.
2. Identify features common in experiments, including the experimental units, treatments, factors, control groups, randomization and blocking.
3. Recognize some common types of sampling design, such as simple random sampling, stratified sampling and multistage designs.

3. Demonstrate an understanding of the basic concepts of probability and random variables.1. Describe the main properties of probability distributions and random variables.
2. Identify the random variable(s) of interest in a given scenario.
3. Contrast discrete and continuous random variables.
4. Find probabilities for distributions over finite discrete sets and for those continuous distributions for which probabilities can be found without the use of calculus.
5. Calculate the mean and variance of a discrete random variable.
6. Recall the key properties of the Normal distribution, including the preservation of Normality under linear transformation.
7. Find the following for a Normal distribution: (i) the probability over a set of values, (ii) a percentile, (iii) the mean or variance given the other and either a percentile or a probability over a set and (iv) the mean and variance given probabilities over two sets.

4. Understand the concept of the sampling distribution of a statistic, and in particular describe the behavior of the sample mean.1. Distinguish between a population and a sample, and between parameters and statistics.
2. Recall the sampling distribution of the mean of a sample from a Normal distribution.

5. Understand the foundations for classical inference involving confidence intervals and hypothesis testing.1. Identify the components of a classical hypothesis test, including the parameter of interest, the null and alternative hypotheses and the test statistic.
2. Compute, or approximate, the P-value of a test statistic.
3. Explain the two types of errors possible and define the associated probabilities.

6. Apply inferential methods relating to the means of Normal distributions.1. Recall the definition of a t statistic in terms of statistics of a sample from a Normal distribution.
2. State and apply the definitions of the t, F and χ2 distributions in terms of the standard Normal.
3. Conduct inference for the mean of a Normal distribution where the underlying variance is either known or unknown, including the construction of confidence intervals and one and two—sided hypothesis tests.
4. Conduct inference about the difference in the means of two Normal distributions, including cases where the underlying variances are known or unknown.

7. Demonstrate an appreciation of one—way analysis of variance (ANOVA).1. Identify situations where one—way ANOVA is and is not appropriate.
2. State the modeling assumptions underlying ANOVA.
3. State the null and alternative hypotheses for the ANOVA test.
4. Explain the partitioning of the total sum of squares into the “within” and “between” group components.
5. Identify the degrees of freedom associated with each sum of squares.
6. Interpret an ANOVA table.
7. Perform the F test in ANOVA, evaluating or approximating the P-value of the test statistic.
8. Use the data to estimate the underlying within—group variance.
9. Explain the output from a software package for an ANOVA study.
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| 12. Student's obligationAt the end of the course, the student should be able to1. Understanding the principles of biostatistics terms.
2. Prepare figures and tables with standard methods.
3. Learning some statistical tests.
4. Learning to judged scientific results through their data.
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| 13. Forms of teachingTeaching method used in lectures1. Data show and power point
2. White board
3. Black Board
4. Paper of lectures
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| 14. Assessment schemeExamination and Marking1. Average of the course: 20% marks Theory.
2. Final exam marks: 30%
3. Total: 50%‌
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| 15. Student learning outcomeThe objective of this course is to provide an understanding for the graduate business student on statistical concepts to include measurements of location and dispersion, probability, probability distributions, sampling, estimation, hypothesis testing, regression, and correlation analysis, multiple regression and business/economic forecasting. By completing this course, the student will learn to perform the following: 1. How to calculate and apply measures of location and measures of dispersion grouped and ungrouped data cases.
2. How to apply discrete and continuous probability distributions to various business problems.
3. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values.
4. Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit. 5) Compute and interpret the results of Bivariate and Multivariate Regression and Correlation Analysis, for forecasting and also perform ANOVA and F-test. Further, understand both the meaning and applicability of a dummy variable and the assumptions which underline a regression model. Be able to perform a multiple regression using computer software.
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| 16. Course Reading List and References‌1. Basic Biostatistics: Statistics for Public Health Practice; B. Burt Gerstman, 20082. Basic Biostatistics for Geneticists and Epidemiologists: A Practical Approach; Robert C. Elston and William D. Johnson, 20083. High Yield Biostatistics; Anthony N. Glaser, 20014. Biostatistics: A Foundation for Analysis in the Health Sciences, 6th edition; Wayne W. Daniel, 19955. Fundamentals of Biostatistics; 7th edition; Bernard Rosner, 20116. Introduction to Biostatistics, 2nd edition; Robert R. Sokal and F. James Rohlf, 20097. Introductory Biostatistics for the Health Sciences; Michael R. Chernick and Robert H. Friis, 2003; 8. Introductory Biostatistics; Chap T. Le, 20039. Topics in Biostatistics; Walter T. Ambrosius, 200710. Introduction to Biostatistics; Larry Winner, 2004Useful references11. Medical Biostatistics I; Harald Heinzl and Georg Heinze, 200912. An Introduction to Biostatistics, 1st edition; Thomas Glover and Kevin Mitchell, 20021. تصميم التجارب و تحليلها, الجزء الاول, د. اكرم عثمان اسماعيل 2003
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| 17. The Topics | **Lecturer's name** |
| 1. Measures of (Location)

Measures of Central Tendency1. Mean
2. Mode
3. Median

The aim of this topicMode, median, mean and Percentile is the first and easy statistical concepts which are used anywhere, any time through scientific researches.Q: What is the relation between mean, median and mode? | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Measures of Variation (Dispersion)

The aim of this topicRange, Interquartile Range, Variance, Standard Deviation, Coefficient of Variation, Standard Error and Combined or Pool Variance deals with distribution of data in their variables and has wide application in researches. | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. The Design of Biological Experiments

Hypothesis Testing (Significant Test)Procedure of Testing Hypothesis* 1. Setup of hypothesis
	2. Detect the significant level
	3. Setting test criteria
	4. Computing or analysis of data
	5. Making decision
	6. Interpretation of data

The aim of this topicThe design of any experiment, whether in the lab or in the field, requires clear idea about:1. What is to be investigated, tested or studied? What do you do or investigate?
2. How the data are to be collected?
3. What is the experiment including the including the data collection?
4. How these are to be displayed and analysis?
5. What is the analysis to give the last outcome?

Testing procedures are1. T-Test
2. Chi Square Test
3. F-Test

Note: we use the T-Test, Chi Square Test, and F Test according to1. Type of distribution.
2. Size of sample.
3. Number of freedom.

Q: when and how the scientist use T-Test, $x^{2}$ Test, and F- Test, explain briefly? | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. T – test

Application of T – testThe aim of this topicSamples always used in experiments and researches, t – test recognized the difference among them if they follow normal distribution.How I compare results with text, other groups, or after and before experiments, these are application of various t – test methods | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Chi square test

Use of Chi squareApplication in chi squareThe aim of this topicCritical experiments with two categories should be tests with chi square to determine the significance of differ if present.Negative or positive results, Dead or lived, vaccinated or not, response or not to treatment, all are some application for biostatistics. | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Correlation

Types of correlationMethods for calculating correlationCorrelation coefficientThe aim of this topicVariables in statistics are related to each other through correlation to know there positive or negative relation with future expectation | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Regression

Types of regressionApplication and characteristics of regressionRegression coefficientThe aim of this topicCorrelation followed by regression to complete the relation among variables. | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Analysis of Variance (ANOVA)

Purpose and use of ANOVAWays of AnalysisModel of DesignPreparation of ANOVA tableThe aim of this topicAnalysis of variance is a multiple t- test that deals with many categories at the same time. | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Analysis of Variance (ANOVA)

Purpose and use of ANOVAWays of AnalysisModel of DesignPreparation of ANOVA tableThe aim of this topicAnalysis of variance is a multiple t- test that deals with many categories at the same time. | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Complete Randomize Design (CRD)

Definition of CRDLayout of DesignSteps of Design Laying outPrinciples of the designUse of CRD | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Complete Randomize Design (CRD)

Advantage and disadvantage of CRDAssumption of designHypothesisAnalysis of designMathematical model of designEstimation of design | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Least Significant Difference (LSD)

Calculation of LSDUse and application of LSD | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Randomized Complete Block Design (RCBD)

ApplicationAdvantage and disadvantageLayout of designAnalysis of designPrinciples of design | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 1. Randomized Complete Block Design (RCBD)

ApplicationAdvantage and disadvantageLayout of designAnalysis of designPrinciples of design | Lecturer's name**Dr. Rebwar M. H. Salih**Time: (2 hrs.) |
| 19. ExaminationsQuestion: Comment on the following1. C.V. is high
2. T. value is significant
3. S.E is low
4. Range is high

Question: Calculate each of the followings1. The followings are some of the particulars of the distribution of weights of boys and girls in class

|  |  |  |
| --- | --- | --- |
| $$Type$$ | $$Boys$$ | $$Girls$$ |
| N | 100 | 50 |
| Mean weight | 60kg | 45kg |
| Variance | 9 | 4 |

Find the standard deviation of combined data?1. When $\sum\_{}^{}x / n$ = 44, $δ$=162.02, calculate C.V?

Question: Give the Formula of the following for calculating1. Chi – square
2. T. test
3. Relation between S.E and Sigma

Question: Use of1. T. test
2. Chi-square test

Question: What is the relation between?1. Mean, mode, and median2. Standard error, standard deviation, and VarianceQuestion: Comparisons1. T test, chi square test and Z test.
2. Correlation and regression
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| 21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ  |