# **Undergraduate Program of Biology Education**

## MODULE HANDBOOK

Module designation	Biometry/KB0620413
Semester(s) in which the module is taught	7 <sup>th</sup>
Person responsible for the module	<ol> <li>Dr. Dewi Lengkana, M.Sc.</li> <li>Rini Rita T. Marpaung, S.Pd., M.Pd.</li> </ol>
Language	Bahasa
Relation to curriculum	elective
Teaching methods	Lecture
Workload (incl. contact	Contact hours: 14 weeks x 100 minutes
hours, self-study hours)	Structured learning: 14 weeks x 120 minutes
	Independent study: 14 weeks x 120 minutes
Teaching Methods	Lectures (100 minutes)
Workfload	Contact hours: 14 weeks x 100 minutes
Credit points	2 sks = (1.28*2) = 2.56 ECTS
Required and recommended prerequisites for joining the module	existing competences in basic mathematics
Module objectives/intended learning outcomes	This course aims to develop students' abilities to learn about the principles, methods and procedures that need to be used in the context of collecting, analyzing, disclosing and discovering data in information processing or research. The scope of his material includes the relationship between statistics and educational research, descriptive statistics, hypotheses and normal distribution, inferential statistics, correlation and also regression. Assessment is carried out on the mastery of lecture material by students.
Content	This course aims to provide knowledge about the basic concepts of statistics which include:
	1. Definition of statistics and its relationship in biological research.
	2. Descriptive statistics for single data.

Descriptive statistics for group data.      Normal distribution.						
4 Normal distribution						
4. Normal distribution						
5. Inferential statistics						
6. Test the sample mean						
7. Mcnemar's test, sign test, Wilcoxon's rank test						
8. Median test and man whitney test						
9. Analysis of correlation and linear regression.						
Essay examination						
Participants are evaluated based on their performance in class						
Performance in theory (100%):						
• Mid Exam (29%)						
• Final Exam (20%)						
• Assignments (25%)						
• Presentation (25%)						
• Class Participations (10%)						
<ol> <li>Sheskin Sheskin J. 2011. Fifth EditionHandbook of Parametric and Nonparametric Statistical Procedures. Chapman &amp; hall/crc is an imprint o ftaylor &amp; f rancis group, a n in form a business no claim to o rig in a l U.S. Government works.</li> </ol>						
<ol> <li>Jurnal statistik aplikasi dalam ilmu hayati, diterbitkan oleh German &amp; Austro-Swiss regions of the International Biometric Society. Impact factor: 1.8 (2024)</li> </ol>						
<ol> <li>Sugiyono. 2003. Statistika untuk Penelitian, Bandung. Alfabeta</li> </ol>						
4. Susetyo, Budi. 2010. Statistika Untuk Analisis Data Penelitian. Bandung. PT. Refika Aditama						

## **Semester Learning Plan (SLP)**

UNIVERSITY OF LAMPUNG

FACULTY OF TEACHER TRAINING AND EDUCATION

DEPARTMENT OF MATHEMATICS AND NATURAL SCIENCES

**BIOLOGY EDUCATION PROGRAM** 

### SEMESTER TEACHING PLAN (RPS)

Course Name	Course Code	Credit Hours (sks)	Semester	Date of Preparation
Conservation of Natural Resources and the Environment	KB0620413	2 (2-0)	1	July 2025
Authorisation	1	Field Coordinator  Expertise (if applicable)	Head of S	Study Programme
	DEWZ-			T. Marpaung,

		Dr. Dewi Lengkana, M.SC.	Rini Rita T. Marpaung, S.Pd., M.Pd						
Learning Outcomes	CPL-PROGRAM (Programme Learning Outcomes) Assigned to Courses								
(LO)	1.Demonstrating scientific, educational, and religious attitudes and behaviours that contribute to improving the quality of life in society, nation, and state based on culture, norms, and academic ethics.								
		itical, systematic, and innovative this oplies humanities values appropriate	nking in the context of the development/implementa to their field of expertise.	tion of science and technology					
	3. Mastering concepts	3. Mastering concepts, principles, theories, laws, and biological processes to solve problems in biology education.							
	CPMK (Course Learning Outcomes)								
	1. Master the concepts, fundamentals, principles, objectives, uses, and types of statistics in educational research.								
	2. Master data analysis techniques in educational research and be able to select the appropriate statistical tests, whether using parametric or non-parametric statistics.								
	3. Be able to prepare a draft design of a statistical test model to be used in educational research, suitable for thesis research.								
Brief Description of the Course	presentation, and interstatistics and education	rpretation of data in information production	at the principles, methods, and procedures required for cessing or research. The scope of the material include ypotheses and the normal distribution, inferential standardery of the course material.	es the relationship between					
Study	1. Introduction								
Materials / Learning	2. Descriptive S	tatistics for Single Data							
Materials	3. Descriptive S	tatistics for Grouped Data							
	4. Normal Distri	bution							
	5. One-Sample	5. One-Sample Inferential Statistics I							

	6. One-Sample I	nferential Statistics II							
	7. Two-Sample I	Mean Test (Independent and Dependent)							
	8. MID Test								
	9. Two-Sample l	Proportion Test, Two-Sample Variance Test							
	10. McNemar's T	est, Sign Test, Wilcoxon Signed-Rank Test							
	11. Median Test,	Mann–Whitney Test							
	12. Inferential Sta	atistics for Samples (One-Way ANOVA)							
	13. Inferential Sta	atistics for Samples (Two-Way ANOVA)							
	14. Correlation A	nalysis and Linear Regression							
	15. Kruskal–Wall	is Test							
	16. Final Test								
Main References:	Primary:								
References.		kin J. 2011. Fifth EditionHandbook of Parametric and Nonparametric Statistical Procedures. Chapman & hall/crc is an vlor & f rancis group, a n in form a business no claim to o rig in a l U.S. Government works.							
	Jurnal statistik     Impact factor:	k aplikasi dalam ilmu hayati, diterbitkan oleh German & Austro-Swiss regions of the International Biometric Society. 1.8 (2024)							
	3. Sugiyono. 200	03. Statistika untuk Penelitian, Bandung. Alfabeta							
	4. Susetyo, Budi	i. 2010. Statistika Untuk Analisis Data Penelitian. Bandung. PT. Refika Aditama							
	Supporters:								

	-
Name	Dr. Dewi Lengkana, M. Sc.
Lecturer	Rini Rita T. Marpaung, S.Pd., M.Pd
Prerequisite Courses (if any)	-

					Asesment				
Wee k	(Planned final	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)	s of Learning [Media & Learning E d		Learning	Criteria & Forms	lindicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
1	Definition of statistics and its relationship in biological research.	Course contract statistics and its relationship in biological research	Sharing of lecture agreements and lecture contracts		ace 2 x 50 minutes		and Q&A	Ability to express opinions in academic agreements	0

							Asesm	ent	
Wee k	Sub-CPMK (Planned final competency)	Course Content (Learning Materials)	earning   Est	Estimate d Time	Learning	Criteria & Forms	Indicators	Percent age (%)	
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
		Descriptive Statistics for Single Data	Lectures and Discussions  Source Learning: Sheskin Sheskin J. 2011. Fifth EditionHandbook of Parametric and Nonparametric Statistical Procedures. Chapman & hall/crc is an imprint of taylor & francis  . 4. Normal distribution	Learning	ace 2 x 50 minutes	a. Discussion concepts Biometry b.Presentation of discussion results with strong arguments c. Question and answer session and confirmation of the accuracy of the discussion results by comparing the discussion results with the group that	Answer	Ability to explain the Basic Concepts biometry	2

				ÿ.			Asesm	ent	
Wee k	Sub-CPMK (Planned final competency)	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)				Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						gave the presentation			
3	Able to explain the basic concepts of Descriptive Statistics for Grouped Data	Statistics for Grouped Data	SPSS – statistical analysis software for descriptive statistics and hypothesis testing.  Source Learning: Sheskin Sheskin J. 2011. Fifth EditionHandbook of Parametric and Nonparametric Statistical Procedures. Chapman & hall/crc is an imprint o ftaylor & Francis group, an in form a business no claim to o rig in a l U.S. Government works	Media: Video Learning Resource s: e-books	ace 2 x 50'	a. Discussion on scientific concepts, working Descriptive Statistics for Grouped Data b. Presentation of discussion results with strong arguments c. Question and answer session and confirmation of the accuracy of the discussion	and Question and Answer	Ability to analyse	2

							Asesm	ent	
Wee k	(Planned final	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)	•			Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						results by comparing the discussion results with the group that gave the presentation			
4	estimates (mean, proportion) in a single sample	Inferential	SPSS – statistical analysis software for descriptive statistics and hypothesis testing.  Source Learning: Sheskin Sheskin J. 2011. Fifth EditionHandbook of Parametric and Nonparametric Statistical Procedures. Chapman & hall/crc is an imprint o ftaylor & Francis group, an in form a business no claim to o rig in a l U.S. Government works.	Media: Videos 4 and 5 Learning Resource s: e-book 3	ace (TM) 2 x 50 minutes	on scientific concepts, working	Activities and Question and Answer	Ability to analyse	2

							Asesment		
Wee k	(Planned final	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)				Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						strong arguments  c. Question and answer session and confirmation of the accuracy of the discussion results by comparing the discussion results with the group that gave the presentation			
5	characteristics of the normal distribution,		Power Point presentations with visual explanations of the normal curve.			a. Discussion on scientific concepts, working scientifically by calculate			

						Asesm	ent		
Wee k	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)	ning	Estimate	Student Learning Experience	Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
	curve, parameters (mean and standard deviation), and the property of symmetry within the context of real-world problems		SPSS – statistical analysis software for descriptive statistics and hypothesis testing.			parameter estimates (mean, proportion) in a single sample) b.Presentation of discussion results with strong arguments c. Question and answer session and confirmation of the accuracy of the discussion results by comparing the discussion results with			

						Asesm	ent		
We k	Sub-CPMK e (Planned final competency)	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)	ning	Estimate		Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						the presenting group			
6	Interpret the results of the analysis in the context of real-world problems to support decision-making				Face (TM) 2 x 50'			Able to analyse	3

							Asesment		
Wee k	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)	ning	Estimate	1	Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						confirmation of the accuracy of the discussion results by comparing the discussion results with the presenting group			
	results of	One-sample inferential statistical	Lectures and Discussions  Media: Video  Learning Resources: e-book 4 and online learning resources		ace (TM) 2 x 50 minutes	a. Discussion on scientific concepts, working scientifically with b. Presentation of discussion results with strong arguments about analysis		Analysing Conservatio n Strategies and Techniques	3

							Asesment		
Wee k	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)	ing		_	Criteria & Forms	Indiantare	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						of conservation strategies and techniques c. Question and answer session and confirmation of the accuracy of the discussion results by comparing the discussion results s with the presenting group			
8	Midterm Exam	-		-	Face-to-f ace 2 x 50 minutes	-	-	-	3

							Asesment			
Wee	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)	ing	Estimate		Criteria & Forms	Indicators	Percent age (%)	
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)	
	results of one-sample	one-sample inferential statistical analysis	Lectures and Discussions		ace 2 x 50 minutes	a. Discussion on scientific concepts, working scientifically with b. Presentation of discussion results with strong arguments about analysis c. Question and answer session and confirmation of the accuracy of the discussion results by comparing the discussion			20	

							Asesment			
Wee k	(Planned final	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)	ing	Estimate	Student Learning Experience	Criteria & Forms	Indicators	Percent age (%)	
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)	
						results s with the presenting group				
	interpret the confidence interval for the population mean	single sample	Lectures and Discussions  Source Learning: e-books and online learning resources	Media: Videos 4 and 5 Learning Resource s: e-books 6 & 7,	50 minutes	a. Discus sion on scienti fic conce pts, worki ng scienti fically by explai ning Conse rvatio n Educa			5	

							Asesment		
Wee k	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)		Estimate d Time	Learning	Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						tion and Social isation Presen tation of discus sion results with ing strong argum ents  a. Questi on and answe r sessio n and confir matio			

							Asesm	ent	
Wee k	(Planned final	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)	ing	Estimate d Time	Learning	Criteria & Forms	lindicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						n of the accura cy of the discus sion results by compa ring the discus sion results with the presen ting group			
	Explain the basic		Lectures, Discussions	Media:		a. Discussion	Non-test:	Ability to	10
2	*	Statistics for Samples		Video	1	on scientific concepts,		analyse Environmen	

							Asesment		
Wee	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)	Ü	Estimate		Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
	statistics, particularly two-way analysis of variance (Two-Way ANOVA)	(Two-Way ANOVA)	Learning resources: e-books	Learning resource s:	minutes  0. x 5 0 m i n u t e s	Ecotourism		tal Economics and Ecotourism	

							Asesment			
Wee k	(Planned final	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)	ing	Estimate	Student Learning Experience	Criteria & Forms	Indicators	Percent age (%)	
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)	
						confirmation of the accuracy of the discussion results				
13-14		Analysis and Linear Regression	Lectures, Discussions  Media:  Learning Resources: e-book	Media: Google Docs for discussio ns Video No. Learning resource s:	ace 2 x 50 minutes 0. x 5 0,	a. Discussion on scientific concepts, working scientifically by analysing b. Presenting the results of the work to obtain feedback from other groups c. Question and answer session and confirmation	Non-test: Active participati on, Q&A,	Ability to analyse Global Issues and Conservatio n Innovations	10	

								Asesm	ent	
Wee k	(Planned final	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)	rces]			ıg	Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)		(6)	(7)	(8)	(9)
15		is Test	Lectures, Discussions  Media: Video: Learning resources: e-book	Media: Google Docs for discussions Learning resource s:	Face-to-f ace 2 x 50 minutes		Discus sion on scienti fic conce pts, worki ng scienti fically by analys ing enviro nment al	Participati on, Question and answer,	Analysing Environmen tal Damage and Degradation of Natural Resources	
							enviro nment			

							Asesm	ent	
Wee k	Sub-CPMK (Planned final competency)	Content (Learning	Forms and Methods of Learning [Media & Learn Resources] (4)	ing	Estimate d Time	_	Criteria & Forms	Indicators	Percent age (%)
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						natura  l resour ce degrad ation  Question and answer session and confirmation of the accuracy of the discussion results by comparing the s of the discussion with the group that presented			

							Asesment		
Wee	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)	Estimate		Criteria & Forms	Indicators	Percent age (%)	
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
15		Kruskal–Wall is Test		Google Docs for discussio	Face (F2F) x 50 minutes	Discussion on scientific concepts, working scientifically by analysing the nature of waste and its impact on the environment and human health.  Creating a prototype of a creative and environmental ly friendly problem-solving tool  Presenting the results of the work to obtain	Active participati on, Q&A, LKM, and prototype products	Actively participating in discussions and generating solutions and simple environment ally friendly prototypes as part of efforts to manage soil pollution	

							Asesment		
Wee k	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)	Estimate	Learning	Criteria & Forms	lindicators	Percent age (%)	
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
						feedback from other groups  Question and answer session and confirmation of the accuracy of the discussion results by comparing the discussion results with the presenting group			
15			Lectures, Discussions and Designing prototypes	Media: Google Docs for discussion	ace (TM) 2 x 50 minutes	Discussion of scientific concepts, working scientifically by analysing the nature of	Non-test: Active participati on, Q&A, LKM, and	and	10

							Asesm	ent	
Wee k	(Planned final	Course Content (Learning Materials)	Forms and Methods of Learning [Media & Learn Resources] (4)		Learning	Criteria & Forms	Indicators	Percent age (%)	
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)
				Learning Resource s: 1-3, and a-c			products	and simple environment ally friendly prototypes as part of efforts to manage air pollution	

							Asesm	Asesment		
Wee k	(Planned final	Content (Learning	forms and Methods of Learning [Media & Learning Resources]  4)			Learning	Criteria & Forms	Hndicators	Percent age (%)	
(1)	(2)	(3)	Offline	Online	(5)	(6)	(7)	(8)	(9)	
						of the accuracy of the discussion results by comparing the discussion results with the group that gave the presentation				
16	Final exam									

#### Note:

- 1. Programme-Specific Learning Outcomes (PSLO) are the competencies possessed by each graduate of the programme, which are the internalisation of attitudes, knowledge mastery, and skills appropriate to the programme level, acquired through the learning process.
- 2. The CPL assigned to a course are several learning outcomes of the study programme (CPL-PRODI) used for the formation/development of a course consisting of aspects of attitude, general skills, specific skills and knowledge.
- 3. Course CP (CPMK) is the ability that is specifically described from the CPL assigned to the course, and is specific to the subject matter or learning material of the course.

- 4. Sub-CP Course (Sub-CPMK) is a capability that is specifically described from CPMK that can be measured or observed and is the final capability planned at each stage of learning, and is specific to the learning material of the course.
- 5. Assessment Criteria are benchmarks used as a measure or yardstick for learning achievement in assessment based on predetermined indicators.

  Assessment criteria are guidelines for assessment to ensure that assessment is consistent and unbiased. Criteria can be quantitative or qualitative.
- **6.** Assessment indicators of student learning abilities in the learning process and outcomes are specific and measurable statements that identify student learning abilities or performance accompanied by evidence.

## MID-SEMESTER EXAM QUESTIONS

### ASSESSMENT OUTLINE

	CPL-PRODI (Program Study Graduate Learning Outcomes) Assigned to Courses  1. Demonstrate scientific, educational, and religious attitudes and behaviours that contribute to improving the quality of life in society, nation, and state based on culture, norms, and academic ethics.  2. Integrating skills and innovation in the mastery of technology and information, career development, and life skills to become life long learners.  3. Applying logical, critical, systematic, and innovative thinking in the context of the development/implementation of science and technology, while considering and applying humanistic values appropriate to their field of expertise  CPMK (Course Learning Outcomes)  1. Able to analyze the requirements for the implementation of a biometric system in a real case  2. Able to prepare scientific reports or presentations related to the analysis of biometric systems using appropriate academic language
Assessment Format	Written test in essay form
Aspects measured	COGNITIVE
Time Allocation	100 minutes

		Competency Achie	evement Indicators					Question Type	Cognitive Level (C1–C6)
<b>No</b> 1	Materials  Descriptive statistics of single data	Calculating the mean, median, mode, variance, and standard deviation of single data	Description/Calculatio	C2, C3	Given the test scores of 10 students: 70, 65, 80, 90, 75, 85, 60, 95, 70, 85. Calculate the mean, median, mode, and standard deviation!	1	Descriptive statistics of single data	Calculating the mean, median, mode, variance, and standard deviation of single data	Description/Calculatio n
2	Descriptive statistics for grouped data	Create a frequency distribution table, calculate the mean, median, mode, and standard deviation of grouped data	Description/Calculation	C3, C4	Given the frequency distribution of students' math scores. Calculate the mean, median, mode, and standard deviation of the grouped data!	2	Descriptive statistics for grouped data	Create a frequency distribution table, calculate the mean, median, mode, and standard deviation of grouped data	Description/Calculation
3	Normal distribution	Explain the characteristics of a normal distribution; calculate probabilities using the standard normal	Description/Calculation	C2, C3, C4	The average height of students is 170 cm with a standard deviation of 5 cm. Calculate the probability	3	Normal distribution	Explain the characteristics of a normal distribution; calculate probabilities using the standard normal	Description/Calculation

distribution	that a student is	distribution	
(Z-table)	between	(Z-table)	
	165–175 cm		
	tall!		

### ASSESSMENT INSTRUMENT

#### **RUBRIC**

**Assessment Section (Essay/Calculation Questions)** 

Assessment Aspects	Score 0	Score 1	Score 2	Score 3	Score 4
Conceptual Understanding	No understanding of the concept at all	Understands the concept very minimally	Understands the concept partially but still incorrectly	Understands the concept correctly but incompletely	
Steps to Solve	No correct steps	There are steps, but they are not relevant	Some steps are correct but there are many errors	Most steps are correct with a few errors	All steps are correct and systematic
Calculations	There are no calculations or they are all wrong	Calculations are mostly incorrect	Calculations are partially correct (≤50%)	Calculations are mostly correct (≥75%)	All calculations are correct
Interpretation of Results	No interpretation	Very incorrect interpretation	Less accurate interpretation	Interpretation is fairly accurate but incomplete	The interpretation of the results is correct, clear, and contextually appropriate

### FINAL EXAM

#### ASSESSMENT GUIDELINES

No	Торіс	<b>Competency Achievement Indicators</b>	<b>Question Type</b>	Cognitive Level (C1–C6)	Sample Questions
1	Two-sample proportion test	Formulate a hypothesis, calculate the two-sample proportion test, and draw conclusions	Description/Calculation	n C3, C4, C5	Of 100 male respondents, 60 like product A; of 120 female respondents, 72 like product A. Test whether there is a difference in proportions at the 5% level!
2	Two-sample variance test (F-Test)	Formulate hypotheses, calculate the F-test for variance, and draw conclusions	Description/Calculation	1 C3, C4, C5	Class A (n=20, s <sup>2</sup> =25), Class B (n=25, s <sup>2</sup> =16). Test whether the two variances are equal at $\alpha$ =0.05!
3	McNemar test	Determine the hypothesis, perform the McNemar test on paired data (nominal)	Description/Calculation	n C3, C4, C5	Before training: 30 agreed, 20 disagreed; after training: 40 agreed, 10 disagreed. Use the McNemar test to see if there is a significant change!
4	Sign Test	Formulate a hypothesis, calculate the sign test on paired data, and draw conclusions	Description/Calculation	n C3, C4, C5	Of the 15 patients tested before and after therapy, there were 12 improvements, 2 declines, and 1 remained unchanged. Use the sign test at $\alpha$ =0.05!
5	Wilcoxon Test	Performing the Wilcoxon Signed Rank Test on paired data	Description/Calculation	1 C3, C4, C5	The pretest and posttest scores of 10 students are provided. Use the Wilcoxon test to determine if there is a significant improvement!
6	Median Test	Testing the equality of the medians of two independent groups	Description/Calculation	ı C3, C4	Two groups of students were given different learning methods. Use the median test to see if the median scores are significantly different!
7	Mann-Whitney test	Using the Mann-Whitney test for 2 independent samples	Description/Calculation	n C3, C4, C5	The test scores for Group A (n=8) and Group B (n=7) are provided. Use the Mann-Whitney test at $\alpha$ =0.05 to determine the difference in medians!

No	о Торіс	<b>Competency Achievement Indicators</b>	Question Type	Cognitive Level (C1–C6)	Sample Questions
8	One-Way ANOVA	Formulate hypotheses, calculate the ANOVA test, and draw conclusions	Description/Calculation	C3, C4, C5	Three learning methods were applied to 3 classes. The test results data is provided. Test with one-way ANOVA whether there is a difference in the means!
9	Two-Way ANOVA	Formulate hypotheses, calculate two-way ANOVA, and interpret main effects and interactions	Description/Calculation	C3, C4, C5	Factor A = type of method, Factor B = gender. Test scores are provided. Perform a two-way ANOVA!
10	Correlation and Linear Regression Analysis	Calculate the correlation coefficient, construct a regression model, test for significance, and interpret the results	Description/Calculation	C3, C4, C5	The height (X) and weight (Y) data of 10 students are given. Calculate the Pearson correlation coefficient, create a regression equation, and test its significance!
11	Kruskal-Wallis test	Perform the Kruskal–Wallis test for k independent samples	Description/Calculation	C3, C4, C5	Three groups of students were given different learning methods. Test scores were provided. Use the Kruskal–Wallis test at $\alpha$ =0.05 to test for differences!

#### MID-SEMESTER EXAM ANSWER

Name: Ade Amalia chance	in a comment of the comment	
MPM: 1963024002 *Midterm	Exam' (20)	)
Assembly 1	1	
). Qiven data . 70,65, 80, 90, 911 81	1,60,91,70,81	
. Man = 77 = 77,5		
And I		
Pata = 60, 65, 70, 70, 71,80,85,	85.40.95	
Median = 2t + 80	1	
Median = 3+ +80 = 7+,5		
. Mode - to and Pr		
. standard deviation		
d = \(\frac{\xi}{\xi}\frac{(\xi, -\xi)^2}{\eta} = \(\int(1)^2\cdot \cdot x = 10\)	, }8	
The state of the s		
2). Cainen data:		
class intend = 40-49 50-59		
	12 15 Q	
-> Mean =0 $\bar{\kappa} = \Sigma \hat{S}_i \hat{\alpha}_i = 9 \cdot 4(44.5) + 6(5)$		
10 TO N = 2 %	= 570 +> Made (grouped da	in estimated
-PMedia , MI ( 5) . 50	90 Made = L + C1	in-f,-f2)
$\frac{-\text{Median} = L + (N(2-f_b) + h)}{\text{Jun}}$	=069+	
5m = 6915+25-22 ×10=6915+3 ×	clo= 69,5+2.0= 71,8) (2	.15-12-8)
		015+3 ×10
ostendard deviations o=125, CK,-x7/N =>	13,68	30-20
3). Data		9,5+3=72,5
//.	from z-table =	
. Mean ( M) = 170 cm		The state of the s
. Mean (M) = 170 cm  · standard deviation (a) = 17cm	· P(241) = 0,8413	
. Mean ( M) = 170 cm	· P(241) = 0,8413 · P(24-1) = 0,86}	
. Mean (M) = 170 cm  . standard deviation (a) = 17cm  . find p (165 \( \times \) \( \times \)   175)	· P(241) = 0,8413 · P(24-1) = 0,1887 · P(-14241) = 0,4913 -	A STATE OF THE PARTY OF THE PAR
. Mean $(M) = 170 \text{ cm}$ . standard deviation $(\alpha) = 170 \text{ cm}$ . find $p(165 \le x \le 177)$ =y $2 = \frac{x - H}{\sigma}$	· P(241) = 0,8413 · P(24-1) = 0,1867 P(-1 = 241) = 0,993 - =0 The probability that	a student'r
. Mean $(M) = 170 \text{ cm}$ . standard deviation $(a) = 170 \text{ cm}$ . find $p(165 \le x \le 177)$ =y $2 = \frac{x - H}{d}$ for $x = 165 : 2 = -1$	· P(241) = 0,8413 · P(24-1) = 0,1807 P(-1 4 241) = 0,9913 - 1 =0 the probability that hight of between 165	a student'r cm dan 195 cm
. Mean $(M) = 170 \text{ cm}$ . standard deviation $(a) = 170 \text{ cm}$ . find $p(165 \le x \le 175)$ =y $2 = \frac{x - M}{d}$ for $x = 165 : 2 = -1$ For $x = 177 : 2 = 1$	P(241) = 0,8413 P(24-1) = 0,1607 P(-1 = 261) = 0,9913 - The probability that hight or between 165 or approximately 66	a student'r cm dan 195 cm
. Mean $(M) = 170 \text{ cm}$ . standard deviation $(a) = 170 \text{ cm}$ . find $p(165 \le x \le 177)$ =y $2 = \frac{x - H}{d}$ for $x = 165 : 2 = -1$	P(241) = 0,8413 P(24-1) = 0,1607 P(-1 = 261) = 0,9913 - The probability that hight or between 165 or approximately 66	a student'r cm dan 195 cm

4). Data:	4.581
M= = 500 populari 5 = 11 & = 0.05	A 2
$M_2 = 500$ populari $S = 1t$ $d = 0.00$ $\sqrt{x} = 510$ $n = 2x$	
Hypothese	
Ho : M : 500	
H, : M \$ 500	
710 - FOD - 22 Av - 21	/
=) t = 510-500 = 3,33, df = 24	
15/025	
critical value \$ 0,05, 24 = 2,064 since 3.33 >2.064, we require	
=1 conclusion at x = 0.05 the tample mean (510) is signifa	cently
different from seo.	
S). Data ,	
10 + 30 Ho: MA = Mb Vs Ho: MA + Mb & = 0,05	
$\vec{x}_A = 75$	/
SA = 8 Test statistic	
$\frac{h_{b}=30}{\bar{x}_{L}=70} \frac{7t-70}{t=(\delta^{2}/30+h^{2}/30)} \frac{5}{[4/30+100/30]} \frac{-5}{2.3}$	2,19,
5) = 10	
=> degree of freedom of= 55	
critical value & =0,00 : to,97,17 = 2.604	
Desition t = 214 7 2,004 - reject to.	
Design t = 214 > 2,004 - 1 repet to.  **Poproximate two tailed p-value = 0,031 (20,05)  **Conclusion	between the
Design t = 214 > 2,004 - 1 reject to.  Approximate two tailed p-value = 0,031 (20,05)  => Conclusion  At the 5% level, there is a statiscally significant difference	between the
Desition t = 214 7 2,004 - 1 reject to.  Approximate two tailed p-value = 0,031 (20,05)  The conclusion	between the obly thou
Desition t = 214 7 2,004 - 1 reject to.  **Poproximate two tailed p - value = 0,021 (20,05)  => Conclusion  **At the 5% level, there is a statiscally significant difference two teaching metods, class a (mean ++) performed significant.	between the orthy thou
Desition t = 214 7 2,004 - 7 reject to.  **Poproximate two tailed p - value = 0,031 (20,05)  => Conclusion  **Pht the 5% level, there is a statiscally significant difference two teaching metods, class a (mean tr) purported tignificant class B (mean to).	between the obly thou
Desition t = 214 7 2,004 - reject to.  Approximate two tailed p-value = 0,031 (20,65)  The the 5% level, there is a statistically significant difference two tracking metods, class a (mean tr) purported highifican class B (mean to).	between the natly thou
Desition t = 214 7 2,004 — reject to.  Approximate two tailed p - value = 0,021 (20,65)  => Conclusion  At the 5% level, there is a statistically significant difference two teaching metods, class a (mean th) performed hypothesis (last B (mean to)).	between the obly thou
Desition t = 214 7 2,004 - reject to.  **Poproximate two tailed p - value = 0.031 (20.65)  => Conclusion  **Pt the 5% level, there is a statiscally significant difference two teaching metods, class a (mean tr) purported hypothemical class B (mean to).  **Data:  **N = 20  **Edi = 105	between the obly thou
Desition t = 214 7 2,004 - 3 reject to.  Approximate two tailed p - value = 0,021 (20,05)  The the 5% level, there is a statistically significant difference two teaching metods, class a (mean tr) purported tignificant class B (nean to).  (b) Data:  1 = 20  2 di = 105	between the natly thou
Desition t = 214 7 2,004 - reject to.  **Poppoximate two tailed p - value = 0.021 (20.65)  => Conclusion  **Pt the 5% level, there is a statistically significant difference two tracking metods, class a (mean tr) purported hypothesis (last B (mean to)).  **Desition t = 214 7 2,004 - reject tho.  **Poppoximate two tailed p - value = 0.021 (20.65)  **Poppoximate two tailed p - value	between the obly thou
Desition t = 214 7 2,004 - 3 reject to.  Approximate two tailed p-value = 0,021 (20,65)  => Conclusion  At the 5% [evel, there is a statisfically significant difference two teaching metods, class a (mean to) purported hypothesis (last B (mean to)).  (b) Data:  • n = 20  Sdi = 105  = 20; = 105 = 85/25  n = 20  Sd = \( \sum{\frac{1}{2}} \sum{2} = 1,16416 = 0 \) deviation Stevelard	between the obly thou
Desirion t = 214 7 2,004 - reject to.  Approximate two tailed p - value = 0,021 (20,65)  => Conclusion  At the 5% level, there is a statistically significant difference two tracking metods, class a (mean to) purported hypothesis (last B (mean to)).  (a) Data:  • n = 20  Edi = 105  T = Edi = 105 = 105/25  n = 20  Sed = \( \sum{E} \) Cdi - T\( \sum{E} \) = 1,16416 = 0 devication Stevelard  n - 1	atly thou
Desition $t = 214 \ 7 \ 2,004 \ -3 \ reject to$ .  Approximate two tailed $p$ - value = 0.021 (20.65)  => Conclusion  At the 5% [evel, there is a statisfically significant difference two teaching metods, class a (mean $p$ ) purported hyporphism class B (mean $p$ 0).  (b) Data:  • $n = 20$ Edi = $105$ $a = 20$ Edi = $105 = 35/25$ $a = 20$ Significant difference to the significant difference that $a = 20$ $a = $	of freedom

b Decision  Since t=20,17 >1.729, V  P-value (approximation)  The one-sided p-value is e  Conclusion  At the 5% shanificance level, after the treatment is poster scores, buth an average inc	e reject Ho. tremey small there is a str st score are	(p<0,009 utically Gi Significa	gnificant iv	uprove went
Since t=20,17 >1.729, V  P-value (approximation)  The one-sided p-value is e  Conclusion  At the 5% significance level,  after the treatment; Posth	tremey small there is a st st score are	(p<0,009 utically Gi Significa	gnificant iv	uprove went
► P-value (approximation)  The one-sided p-value is e  Lonclusion  At the 5% Stanificance level,  after the treatment; Posth	tremey small there is a st st score are	(p<0,009 utically Gi Significa	gnificant iv	uprove went
The one-sided p-value is e longlusion  At the 5% stanificance level, after the treatment; posts	there is a str st score are	utically Gi Significa	gnificant iv	uprove went
At the 5% significance level, after the treatment ? Posts	there is a str st score are	utically Gi Significa	gnificant iv	uprove went
At the 5% stanificance level, after the treatment; posts	st score are	significa	untly higher	uprove went than pretest
after the treatment; posts	st score are	significa	untly higher	than fretest
Acores, with an average and	ease of abo	ut 5,25	Points.	
yours, with wi				
			1 1	
		- 17		
		2.4		E VOY
	-			

## FINAL EXAM ANSWER

Jame : Ade Amalia CHansa	
MPM : 1963024002	The second second
Final Ser	nester Ekam
	6
Aswer:	(300
Problem :	C F
	to make to
- Out of 100 male respondents 60 li	produce A.
- Duk of 120 female respondents 72 h	proportions at the 5% synificance lovel.
a. Hypothese	high tinil at an ab tidulicant
	ections)
· Ho: pr = p2 (no difference in prop	In Propostians)
1, 1, (	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
1. Sample Proportions	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
· Male , }, = 60 (100 = 0,60	N /
· fande : p2 = 72/120 = 0.60	
· pooled proportion:	service of themselves and police
	$\frac{672}{120} = \frac{132}{220} = 0.60$
	120 220
c. Standard error	
SE = \( \frac{1}{n_1} \left( \left( \frac{1}{n_2} \right) = \l	0,60 × 04 × (0,01 + 10,00 833)
	0663
d. Test Statistic	
$2 = \frac{p_1 - p_2}{2} = \frac{0.60 - 1}{2}$	0,60 = 0
SE 0.0663	
e. Decigion	The second secon
at a = 0.05, the critical value	
spice 2 = 0 free within the accept	ance region, we fail to reject Ho.
=1 Conclution:	
There it no organificant a	difference to the proportions of modes oduct to At the 17 significance herel.
and fundes who like pr	oduct or At the 12 nanificana here!
All Landson St. Company of the Compa	and the second second second
	Property Statement & Back Balling
	The state of the s

2). Data	
Clart A: n1 = 20, s1 = 25 -> d1 = n1-1 = 19	
· class & : n. = 25, 51 = 16 - df2 = n2 -1 = 24	
Hypothese	Artine and the second s
Ho: 61 = 01 H, : 01 + 01	
Test statistic	
F = 51 = 25 = 1,5625	KØ 1
F : 5' = 25 = 1,5625  5' 16  Critical value a = 0.05	
Critical value & = D.Os	Pina de la companya del companya de la companya de la companya del companya de la
Fo,975; 19,24 = 2.3452 Fo,003 - 1	= 0,4078
fo.975; 24,8	
Reject Holy F>2,3452 or \$ < 0,4078	) /
Degrion	
F = 1. 1625 lief Lewen 0,4071 and 2.3452	
Therepore we got to reject Ho.	
-) Londugen	
At the 1% singnificale lad there is no evidence	that the population
variances of class & and class & differ.	
2) 11. +16. (40.00 0 0 1.0)	
3) Menumar Table (Before x Apter)	
Beport Agree Disagree foral	
Bepowl After Agree Disagree total Agree a b 20 Diagree c d 20	
70ta	
· Tot Statistic	V
Test statistic	
1 J+c J+c b+c	
. 4a = 20 = 16 : 10 . C = 20 . b + C = 30	
14a = 30 = 1 b = 0 , C = 10, b + C = 10	= 0,05
14a = 30 = 1 b = 0 , C = 10, b + C = 10	
X1 = 100/10 = 10, p = 0,0016 - reject to at x	= 0.05
,	
4). Data:	Microfil Lings of Light and
. Patrot n 215 duline: 2 effects	on n=12+2=14
· Improvement: 12 no change: 1	
Ho X - binomial (4,05), where X = number of 1	mprovement
· P(x > 12) = P(x = 12) + P(x = 13) + P(x = 14)	The second secon
= (14) 2-14 + (14) 22-14 + (14) 2-14	and the second s
13/ 19/2	

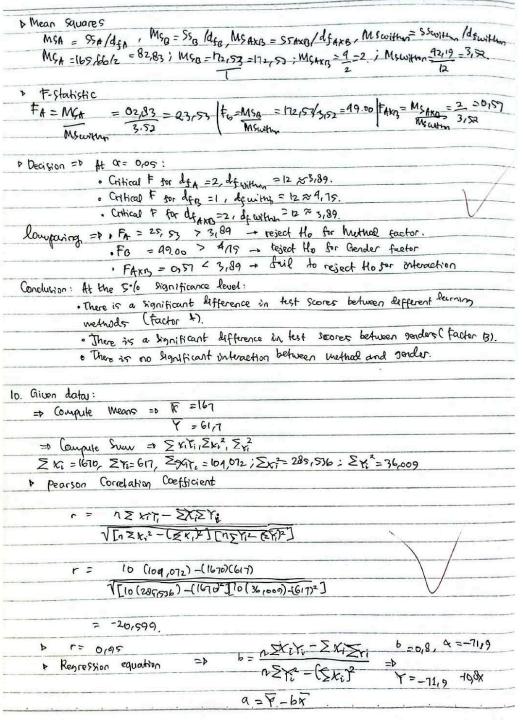
```
= 0,00555 + 0,000855 + 0,000061 = 0,0064
 Two sided y value = 2 x 0,00647 = 0,01294

Destran at d=0,05 = 1 p = 0,0129 < 0,05 - reject to.
7) Condusion
        There is a statescally significant change significantly more patronto
        improved after thropy.
                                                                          73
 t). Gaven data => Pretest: 60 69
                                    72
                 Postest: 70
                              68 15
                                                                          80
   di = Postlest - Pretest
   & Calculate furt Statistic
    / · Swan of positive ranks Tt= 1.5+ 2.5+ 3.5+5+ 6.5+ 6.5+0+0+10= 53,5
     · hun of negative ronks T= 1.5
    Test Statistic T= mm(T+, T-)=1.5
    & Decision we
         for n = 10 ( puirs $0 ), the critical value of Wilcoron Staned-Rank test at a = 0,05
           (two-tuled) 28.
          · Since T = 1.5 < 8, we reject to.
6). Midian test
   · the combined data (n=12) gave an overall median = 59,1
   . Group A : 7 above median, T below
  Group B = 4 above median, 6 lelow
  . Test statustick , X2 = 0+3 df = 1, p = 0.39
  . since p > 0,0+, we fall to reject the
  => Conclusion
        there it no significant difference in the median rester between
        the two group at the tyo significance level.
7). Given data => Group A: MA = 8
   · Group &
                    Group B: MB=7
                                                Su total panks = 120
      Rangs = 315 +7+9+ 11+12+ 13+14+15= 84,5
       Group B ronts = 120 -89,5=38
     & Compute U Statistic
                          UA = NAMB + NA (MA+1) -PA
                          U += 0x7 + 8x9 -84,5 = $6+36-84.5 = 7.5
```

```
UB = NANB - UA = 56-7.5= 48,5
                  So, U = min (U), UB) = 78
   P Decision
        From Mann-Whitney 4 Critical values table for not = 8, ng = 7, at a = 0,00
             (two-twiced), contral value = 13.
           Fince U= 7,5 < 13, We Reject Ho.
    a Conducion: At the 5% hanificance level, there is a significant difference
                   medians between arroup t and Group B.
                                r Calculate Moans
\overline{K}_{1} = 75 + 78 + 80 + 74 \times 77/5 = 384/5 = 76,8
\overline{K}_{2} = 82 + 85 + 84 + 81 + 87/5 = 417/5 = 87,0
8) Given data:
     >Class 1:n, =5
    = Class II: 12 =9
                                 K3 =90 +88 +85 +89 +87/5= 439/5= 87,0
     , Cass III : Na =5
    & Grand Mean
               X = 384+915+939/15 = 1238/15 = 82,53
    Calculate Sum of Educies Between Groups (SSB)
SSB = \sum_{l=1}^{n} n_{l}(\overline{X}_{2} - \overline{X}_{l})^{2}
             SSB = 5 (76.8-82,53)2+5(83.0-82,53)2+5(87.8-82,53)
         Class 1 = 9(-9,73)2=164.15
               11 = 500,A772: 1.10
         Ju = 5(0,47)2 - 138,85
                                                     =0 304,10
      P SGW ( Square Withy Grays)

SSW = \sum_{i=1}^{N} (K_{ij} - K_i)^2
                       SSW = 22.80 +10+14,80=47,60
         P pagrees of freedom
                   df between = tr -1 = 3-1 = 2df within = NK=15-3=12
           o Mean
                     squares
                                     = 309.60 =152.05 Mgw = SSW
                                                                              47,60 28,97
                            = + = MSB = 152,05 = 38,32
 blacision => At a =0,05 with dq =2, dfz=12, the critical =3,89.
                    Since 30,32 >63,89, we Reject the of there is a typnificant differe
  SIDU
```

g) Given data		Fe 1-
Method/aender	Male	Female
Method 1	78,82,80	85,88,90
Method 2	15,77,79	80,83,89
Method 3	82,84,86	88 ,90,92
rue have tach	or #= type of Nethod	(3 levels)
· facto	r B = Gender (a leve	15)
• n= 1	per cell Coach method	(gender Combination)
Cell means Method	1 Male: C78+02+00/3	=8%
· Method	4 temase: (85+08+90)	13 = 87,67
· Method	12 Male = (75+77+79)	3 = 710
, Weller	Q 2 female: (80+83+85)	13=82,67
· Metho	d 3 Male: (82+89+867	1/3 = 84,0
	& 3 Femalo: (88+90+92	
	= (80,0+87,67)/2=8318	
M2	= (77,0+82677 /2 = 79,8	13
, M2,	= C84 +901/2 = 87	
	le = (80 +77+84)/3=80,3	33
. Few	rale = (87,67+82,67+90)	/3 = 86 . u
* Total SS =0 SS++	$= \frac{\text{Shw of all scores}}{N}$ $= \sum (x_{ijk} - \overline{x})^2$	18
V 95A = nB.n.≥1		
		13.43.1 406. 11.2
= 6 -0,50)	2+(-4.50)2+(2.67)2)	
P SSA = 6[0/25.	+2025+7,11] = 6[27,6]	= 165,66
P 9913 = nA.n. =		
3		A Adalah
SSB =9 T(80.	33 -84.33) 7 (86.11-84.3	32]= 9[16+3.17]=9(19.17]=12,53-
SSA4. = 0	$\sum_{i} (\bar{x}_{ij} - \bar{x}_i - \bar{x}_j + \bar{x})^2$	-4.0
DXW - 1	7-3	
Ss without = 30	0-165,66 -172,93-4.0=	42,19
begree of freedom	- 100 4 100	
· dfA = ~-1=2	dfwiften	=N-ab=18-c=12
· dfa = 10-1 =1		. 130 1.
· df AxB = (a-1) (1	2-1) = 2k1 = 2	
SiDU		



a significance tets of r t = ~ 1 - 12 r=0195 /n=16 Degree of freedow: n=2=8 Critical traduce for 0=0,05 02,306. Since t=0,50 >2,306 , we reject tho-the correction is rightfount. 1 final Answer · Pearson Correlation coefficient : 1 % 0,99 · Regression equation: Y= -71,9+0,8× b Agnificance: Correctation is hynificant at 0=0,05. U. Given data, AM score: 75, 76, 78, 80, 82, 82, 85, 86, 88, 88, 90, 90, 02, 94 Where: · N = 15 (toke scores) & = 7 900ups U? = 2 (be sweet) Ri = rank Sums b Decision lalar late: - begree of freedow: &f = k-1 = 2. · 15x 16 = 240, so 12/290 = 0,05 Critical value from 102 tuble at 00=0105 0 39,5 = 1560.29 = 312,05 -> 020071= 5,991. . 19.52 = 380.25 = 76,05 Since # = 8,615 >5,991, we reject Ho. . 61 = 3721 = 799,2 londusion: There is a significant Sum = 312,05 +7605 +749, 2= 1132,3 H = 0,05 × 1132,5 -48 = 56,615-48 = 8,615 difference between the groups medians.