

# MODULE HANDBOOK

## REGRESSION ANALYSIS



**STATISTICS UNDERGRADUATE PROGRAM  
DEPARTMENT OF STATISTICS  
FACULTY OF SCIENCE AND DATA ANALYTICS  
INSTITUT TEKNOLOGI SEPULUH NOPEMBER  
SURABAYA**

## ENDORSEMENT PAGE



### MODULE HANDBOOK REGRESSION ANALYSIS STATISTICS UNDERGRADUATE PROGRAM DEPARTMENT OF STATISTICS INSTITUT TEKNOLOGI SEPULUH NOPEMBER

Proses <i>Process</i>	Penanggung Jawab <i>Person in Charge</i>			Tanggal <i>Date</i>
	Nama <i>Name</i>	Jabatan <i>Position</i>	Tanda tangan <i>Signature</i>	
Perumus <i>Preparation</i>	Santi Puteri Rahayu, Ph.D	Dosen Lecturer		
Pemeriksa dan Pengendalian <i>Review and Control</i>	Santi Puteri Rahayu, M.Si., Ph.D ; Dr. Ir. Setiawan, MS; Dr. Muhammad Sjahid Akbar, M.Si; Dr. Ismaini Zain, M.Si	Tim kurikulum Curriculum team		
Persetujuan <i>Approval</i>	Dr. Ir. Setiawan, MS	Koordinator RMK Course Cluster Coordinator		
Penetapan <i>Determination</i>	Dr. Kartika Fithriasari, M.Si	Kepala Departemen Head of Department		

# MODULE HANDBOOK

## REGRESSION ANALYSIS

Module name	REGRESSION ANALYSIS	
Module level	Undergraduate	
Code	SS234308	
Course (if applicable)	REGRESSION ANALYSIS	
Semester	3	
Person responsible for the module	Santi Puteri R, M.Si, Ph.D	
Lecturer	Santi Puteri Rahayu, M.Si., Ph.D ; Dr. Ir. Setiawan, MS; Dr. Muhammad Sjahid Akbar, M.Si; Dr. Ismaini Zain, M.Si	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory, 3rd semester.	
Type of teaching, contact hours	Case Method (20%); Team Based Project (20%); Other SCL Methods (40%); Non SCL (20%)	
Workload	1. Lectures [L]: 3 x 50 = 150 minutes perweek. 2. Exercises and Assignments [EA] : 3 x 60 = 180 minutes (3 hours) perweek. 3. Independent learning [IL] : 3 x 60 = 180 minutes (3 hours)perweek.	
Credit points	3 credit points (SKS) Equivalent to 4.8 ECTS	
Requirements according to the examination regulations	A student must have attended at least 80% of the lectures to sit in the exams.	
Mandatory prerequisites	-	
Learning outcomes and their corresponding PLOs	<p>CLO.1 Be able to explain concepts and apply the theory of regression analysis</p> <p>CLO.3 Able to analyze data with the regression method and interpret it</p> <p>CLO.4 Able to identify, formulate and solve problems in various applied fields with regression analysis</p>	<p>PLO-1 PLO-3</p> <p>PLO-3</p> <p>PLO-4</p>
Content	REGRESSION ANALYSIS is a subject in the field of theory, which aims to master the basic concepts of mathematics to understand the theory of vectors, basic operations of REGRESSION ANALYSIS, determinants, inverses, random vectors, systems of linear equations, vector spaces, values, and eigenvectors. Besides that, students able to use this concept for processing random variables, formulating modeling and calculating univariate and multivariate calculations. To achieve this goal, the learning strategy used is	

	discussion and practice both manually and with a computer program package
Assessment and its weight	Assignment I – 25% Midterm Exam – 25% Assignment II – 25% Final Exam– 25%
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom
Reading list	<ol style="list-style-type: none"> <li>1. Draper, N., and H. Smith, 1998. Applied Regression Analysis. 2nd edition</li> <li>2. Myers, R. H. 1989. Classical and Modern Regression with Applications. Boston: PWS-Kent Publishing Company</li> <li>Weisberg, S., 1986. Applied Linear Regression, John Wiley &amp; Sons, New York.</li> <li>3. Montgomery, D.C. and Peck, E.A., 1982. Introduction to Linear Regression Analysis. New York: John Wiley and Sons Inc.</li> <li>4. Walpole Engineering Statistics Handbook.</li> </ol>



**INSTITUT TEKNOLOGI SEPULUH NOPEMBER**  
**FAKULTAS SAINS DAN ANALITIKA DATA**  
**PROGRAM STUDI SARJANA STATISTIKA**  
**DEPARTEMEN STATISTIKA**

**Kode Dokumen**

**RENCANA PEMBELAJARAN SEMESTER/**  
**SEMESTER LEARNING PLAN**

<b>MATA KULIAH (MK)/</b> <i>Course</i>	<b>KODE/</b> <i>Code</i>	<b>Rumpun MK/</b> <i>Course Group</i>	<b>BOBOT (sks)/</b> <i>Weight (credit)</i>		<b>SEMESTER/</b> <i>Semester</i>	<b>Tgl Penyusunan/</b> <i>Drafting Date</i>
<b>ANALISIS REGRESI/</b> <i>REGRESSION ANALYSIS</i>	SS234308	ANDEF	<b>T=</b>	<b>P=</b>	III	17 Desember 2022
<b>OTORISASI/</b> <i>AUTHORIZATION</i>	<b>Pengembang RPS/</b> <i>RPS Developer</i>	<b>Koordinator RMK/</b> <i>Course Group Coordinator</i>		<b>Ketua PRODI/</b> <i>Head of Department</i>		
	Santi Puteri Rahayu, M.Si., Ph.D ; Dr. Ir. Setiawan, MS; Dr. Muhammad Sjahid Akbar, M.Si; Dr. Ismaini Zain, M.Si	Santi Puteri Rahayu, M.Si., Ph.D		Dr. Kartika Fithriasari, M.Si		
<b>Capaian Pembelajaran (CP)/</b> <i>Learning Achievement</i>	<b>CPL-PRODI yang dibebankan pada MK/</b> <i>PLO</i>					
	CPL-1	Mampu menerapkan pengetahuan sains, teori statistika, matematika, dan komputasi untuk menyelesaikan permasalahan dalam berbagai bidang terapan				
	CPL-3	Mampu menganalisis data dengan metode statistika yang tepat dan menginterpretasikannya				
	CPL-4	Mampu mengidentifikasi, memformulasi, dan menyelesaikan masalah statistika di berbagai bidang terapan				
	<i>PLO-1</i>	<i>Able to apply knowledge of science, statistical theory, mathematics, and computation to solve problems in various applied fields</i>				
	<i>PLO-3</i>	<i>Able to analyze data with appropriate statistical methods and interpret them</i>				
	<i>PLO-4</i>	<i>Able to identify, formulate, and solve statistical problems in various applied fields</i>				
	<b>Capaian Pembelajaran Mata Kuliah (CPMK)/</b> <i>CLO</i>					
	CPMK.1 Mampu menjelaskan konsep dan menerapkan teori analisis regresi					
	CPMK.3 Mampu menganalisis data dengan metode regresi dan menginterpretasikannya					
	CPMK.4 Mampu mengidentifikasi, memformulasi dan menyelesaikan problem di berbagai bidang terapan dengan analisis regresi					

	<p><i>CLO.1 Be able to explain concepts and apply the theory of regression analysis</i></p> <p><i>CLO.3 Able to analyze data with the regression method and interpret it</i></p> <p><i>CLO.4 Able to identify, formulate and solve problems in various applied fields with regression analysis</i></p>																																							
	<p><b>Matrik CPL – CPMK</b> <i>PLO-CLO Matrix</i></p> <table border="1"> <thead> <tr> <th></th> <th>CPL 1</th> <th>CPL 3</th> <th>CPL 4</th> <th></th> </tr> </thead> <tbody> <tr> <td>SUB CPMK 1.1</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>SUB CPMK 1.2</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>SUB CPMK 3</td> <td></td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>SUB CPMK 4.1</td> <td></td> <td></td> <td>√</td> <td></td> </tr> <tr> <td>SUB CPMK 4.2</td> <td></td> <td></td> <td>√</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		CPL 1	CPL 3	CPL 4		SUB CPMK 1.1	√	√			SUB CPMK 1.2	√	√			SUB CPMK 3		√			SUB CPMK 4.1			√		SUB CPMK 4.2			√										
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<p><b>Deskripsi Singkat MK/</b> <i>Course Description</i></p>	<p>Analisis regresi adalah salah satu topik dalam ilmu statistika untuk mendapatkan model yang menyatakan hubungan antara variabel respon dan variabel prediktor. Model dapat digunakan untuk mendeteksi kemaknaan pengaruh predictor pada respon, serta dapat digunakan pula untuk memprediksi respon bila predictor ditentukan atau diketahui. Untuk mendapatkan capaian pembelajaran diperlukan metode pembelajaran yang terdiri atas: ceramah, diskusi, latihan, dan tugas.</p> <p><i>REGRESSION ANALYSIS is a subject in the field of theory, which aims to master the basic concepts of mathematics to understand the theory of vectors, basic operations of REGRESSION ANALYSIS, determinants, inverses, random vectors, systems of linear equations, vector spaces, values, and eigenvectors. Besides that, students able to use this concept for processing random variables, formulating modeling and calculating univariate and multivariate calculations. To achieve this goal, the learning strategy used is discussion and practice both manually and with a computer program package</i></p>																																							
<p><b>Bahan Kajian: Materi Pembelajaran/</b> <i>Course Material</i></p>	<p>Dasar Sains, Teori Statistika, Pengumpulan Data, Deskripsi dan Eksplorasi, Komputasi dan data Prosesing, Pemodelan, Industri Bisnis, Pemerintahan dan Kependudukan, Ekonomi dan Manajemen, Kesehatan dan Lingkungan, dan Sosial Humaniora</p> <p><i>Basic Science, Statistical Theory, Data Collection, Description and Exploration, Computing and Data Processing, Modeling, Business Industry, Government and Population, Economics and Management, Health and Environment, and Social Humanities</i></p>																																							
<p><b>Pustaka/</b> <i>References</i></p>	<p><b>Utama/Primary:</b></p>	<p>1. Draper, N., and H. Smith, 1998. Applied Regression Analysis. 2nd edition</p>																																						

	2. Myers, R. H. 1989. Classical and Modern Regression with Applications. Boston: PWS-Kent Publishing Company <b>Pendukung/Secondary:</b> 3. Weisberg, S., 1986. Applied Linier Regression, John Wiley & Sons, New York. 4. Montgomery, D.C. and Peck, E.A., 1982. Introduction to Linear Regression Analysis. New York: John Wiley and Sons Inc. 5. Walpole Engineering Statistics Handbook.						
<b>Dosen Pengampu/ Lecturers</b>	Santi Puteri Rahayu, M.Si., Ph.D ; Dr. Ir. Setiawan, MS; Dr. Muhammad Sjahid Akbar, M.Si; Dr. Ismaini Zain, M.Si						
<b>Matakuliah syarat/ Pre-requisite Course</b>	-						
Mg Ke- Week	Kemampuan akhir tiap tahapan belajar (Sub-CPMK) <i>Final capability for each learning step</i>	Penilaian <i>Evaluation</i>		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, <i>[Estimasi Waktu]</i>  <i>Learning Format Learning Methods Assignment for Student [Estimated Time]</i>		Materi Pembelajaran <i>[Pustaka] Learning Material [References]</i>	Bobot Penilaian (%) <i>Evaluation Weight (%)</i>
		Indikator <i>Indicator</i>	Kriteria & Bentuk <i>Criteria and Format</i>	Luring <i>Offline</i>	Daring <i>Online</i>		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

<p><b>1-3</b></p>	<p>Mampu membuat model regresi linier garis lurus antara suatu kejadian atau respon kuantitatif dengan satu prediktor dengan mengevaluasi kondisi error atau galat secara manual maupun software, serta merumuskan interpretasinya [Sub CPMK 1.1]</p> <p><i>Able to make a straight-line linear regression model between an event or quantitative response with one predictor by evaluating error or error conditions manually or software, and formulating the interpretation</i> [Sub CPMK 1.1]</p>	<p>a. Mampu memahami definisi model regresi linier dan terminologi unsur yang terkait (jenis variabel, jenis data, struktur data)</p> <p>b. Mampu memahami konsep perbedaan dan hubungan antara analisis regresi dan korelasi linier</p> <p>c. Mampu menghitung penaksir parameter menggunakan metode OLS dan penaksir respon secara titik dan interval</p> <p>d. Mampu membentuk model berdasarkan data dan menginterpretasikannya</p> <p>e. Mampu membuat Tabel ANOVA.</p> <p>f. Mampu melakukan pengujian hipotesis.</p> <p>g. Mampu menganalisis error secara visual.</p> <p><i>a. Able to understand the definition of a linear regression model and related element terminology (variable types, data types, data structures)</i></p> <p><i>b. Able to understand the concept of difference and the relationship between regression</i></p>	<p>Tugas latihan soal dan atau kuis</p> <p><i>Assignments of practice questions and or quizzes</i></p>	<p>Ceramah interaktif, Latihan, diskusi <i>Interactive Lectures, Exercises, and Discussions</i></p> <p><b>TM: 3x3x50"</b> <b>PT: 3x3x60"</b> <b>BM: 3x3x60"</b></p>		<p>Penaksiran parameter dan prediksi respon dengan satu prediktor . [Pustaka 1]</p> <p><i>Parameter estimation and response prediction with one predictor .</i> [Reference 1]</p>	<p>20%/20%</p>
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		<p><i>analysis and linear correlation</i></p> <p><i>c. Able to calculate parameter estimators using the OLS method and response estimators at points and intervals</i></p> <p><i>d. Able to form models based on data and interpret them</i></p> <p><i>e. Able to make ANOVA Tables.</i></p> <p><i>f. Able to do hypothesis testing.</i></p> <p><i>g. Able to analyze errors visually.</i></p>				
4-7	<p>Mampu membuat model regresi linier berganda antara suatu kejadian atau respon kuantitatif dengan dua atau lebih prediktor dengan mengevaluasi kondisi error atau galat secara manual maupun software, serta merumuskan interpretasinya [Sub CPMK 1.2]</p> <p><i>Able to create multiple linear regression models between an event or quantitative response</i></p>	<p>a. Mampu menghitung penaksir parameter dan penaksir respon secara titik dan interval, menggunakan metode OLS pendekatan matrik.</p> <p>b. Mampu membentuk model berdasarkan data dan menginterpretasikannya</p> <p>c. Mampu membuat Tabel ANOVA pendekatan matrik.</p> <p>d. Mampu melakukan pengujian hipotesis.</p> <p>e. Mampu menganalisis error secara visual.</p> <p>f. Mampu menghitung jumlah kuadrat error partial dan sequential</p>	<p>Tugas latihan soal <i>Assignments of practice questions</i></p>	<p>Ceramah interaktif, Latihan, diskusi <i>Interactive Lectures, Exercises, and Discussions</i></p> <p><b>TM: 4x3x50"</b> <b>PT: 4x3x60"</b> <b>BM: 4x3x60"</b></p>	<p>Penaksiran parameter dan prediksi respon dengan dua atau lebih prediktor pendekatan matrik [Pustaka 1 &amp; 2] <i>Parameter estimation and response prediction with two or more matrix approach predictors [References 1 &amp; 2]</i></p>	30%/50%

	<i>with two or more predictors by evaluating error or error conditions manually or software, and formulating the interpretation. [Sub CPMK 1.2]</i>	<p>serta melakukan pengujian</p> <p><i>a. Able to calculate parameter estimators and response estimators at points and intervals, using the matrix approach OLS method.</i></p> <p><i>b. Able to form models based on data and interpret them</i></p> <p><i>c. Be able to make a matrix approach ANOVA table.</i></p> <p><i>d. Able to do hypothesis testing.</i></p> <p><i>e. Able to analyze errors visually.</i></p> <p><i>f. Able to calculate the number of squared partial and sequential errors and perform testing</i></p>					
<b>8</b>	<b>ETS/Midterm</b>						
<b>9-10</b>	Mampu membuat model regresi linier berganda antara suatu kejadian atau respon kuantitatif dengan dua atau lebih prediktor, dengan mengevaluasi kondisi error atau galat secara manual maupun software, serta merumuskan interpretasinya [Sub CPMK 3]	<p>a. Mampu membuat variabel dummy dan melakukan pemodelan regresi dummy tanpa interaksi dengan matrik serta menginterpretasikannya</p> <p>b. Mampu melakukan pemodelan regresi dummy interaksi dengan matrik dan menginterpretasikannya</p>	Tugas latihan soal <i>Assignments of practice questions</i>	Ceramah interaktif, Latihan, diskusi <i>Interactive Lectures, Exercises, and Discussions</i>  <b>TM: 2x3x50"</b> <b>PT: 2x3x60"</b> <b>BM: 2x3x60"</b>		Penaksiran parameter regresi dengan prediktor kuantitatif dan atau kualitatif pendekatan matrik [Pustaka 1]  <i>Estimation of regression parameters with quantitative predictors and or qualitative matrix approaches [Reference 1]</i>	10%/60%

	<p><i>Able to create multiple linear regression models between an event or quantitative response with two or more predictors, by evaluating error or error conditions manually or software, and formulating the interpretation</i> [Sub CPMK 3]</p>	<p>c. Mampu menghitung Jumlah kuadrat Sequential dan Partial pada model regresi dummy serta melakukan pengujian</p> <p>a. <i>Able to create dummy variables and perform dummy regression modeling without interaction with matrices and interpret it</i></p> <p>b. <i>Able to perform dummy interaction regression modeling with matrices and interpret it</i></p> <p>c. <i>Able to calculate the sum of the Sequential and Partial squares in the dummy regression model and perform testing</i></p>					
11-12	<p>Mampu membuat model-model regresi yang lebih kompleks disesuaikan dengan kondisi prediktor, respon, dan error, serta mampu mengambil keputusan yang tepat atas berbagai metode regresi yang digunakan, secara manual maupun software. [Sub CPMK 4.1]</p> <p><i>Able to make more</i></p>	<p>a. Mampu memahami heteroskedastisitas dan mendeteksinya secara visual serta menggunakan WLS dengan satu macam pembobot untuk :</p> <p>i. Menghitung penaksir parameter pendekatan matrik.</p> <p>ii. Membuat Tabel ANOVA, pendekatan</p>	<p>Tugas latihan soal dan atau kuis <i>Assignments of practice questions and or quizzes</i></p>	<p>Ceramah interaktif, Latihan, diskusi <i>Interactive Lectures, Exercises, and Discussions</i></p> <p><b>TM: 2x3x50"</b> <b>PT: 2x3x60"</b> <b>BM: 2x3x60"</b></p>		<p>Pemodelan untuk menanggulangi heteroskedastisitas, menanggulangi unusual observation, dan menanggulangi ketidaknormalan [Pustaka 1 &amp; 2]</p> <p><i>Modeling to overcome heteroscedasticity, overcome unusual observations, and overcome abnormalities</i> [References 1 &amp; 2]</p>	15%/75%

	<p><i>complex regression models according to predictor, response, and error conditions, and able to make the right decisions on the various regression methods used, manually or software.</i> [Sub CPMK 4.1]</p>	<p>matrik.</p> <p>iii. Menghitung prediksi respon.</p> <p>b. Mampu memahami unusual observation dan mendeteksinya, serta menggunakan metode IRWLS dengan satu macam pembobot untuk membuat regresi Robust, pendekatan matriks.</p> <p>c. Mampu melakukan transformasi Box Cox untuk menanggulangi ketidaknormalan dalam membuat model regresi.</p> <p>d. Mampu menghitung penaksir parameter model regresi menggunakan metode Maksimum Likelihood.</p> <p>a. <i>Able to understand heteroscedasticity and detect it visually and use WLS with one kind of weight for:</i></p> <p>i. <i>Calculating matrix approximation parameter estimators.</i></p> <p>ii. <i>Make ANOVA table, matrix approach.</i></p> <p>iii. <i>Compute response predictions.</i></p> <p>b. <i>Able to understand unusual observation and detect it and use</i></p>					
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		<p><i>IRWLS method with one kind of weight to make Robust regression, matrix approach.</i></p> <p><i>c. Able to perform Box Cox transformation to overcome abnormalities in making regression models.</i></p> <p><i>d. Able to calculate the parameter estimator of the regression model using the Maximum Likelihood method.</i></p>					
<b>13-14</b>	<p>Mampu membuat model-model regresi yang lebih kompleks disesuaikan dengan kondisi prediktor, respon, dan error, serta mampu mengambil keputusan yang tepat atas berbagai metode regresi yang digunakan, secara manual maupun software. [Sub CPMK 4.1]</p> <p><i>Able to make more complex regression models according to predictor, response, and error conditions, and able to make the right decisions on the various regression methods used, manually or</i></p>	<p>a. Mampu memahami multikolinieritas, mendeteksinya dengan VIF dan memahami terminologi terkait (ill conditioning, centering scalling) serta membuat model regresi metode Ridge (Gulud)</p> <p>b. Mampu membentuk model regresi polinomial orthogonal sederhana</p> <p>c. Mampu melakukan seleksi antar model regresi dan menentukan yang terbaik sesuai kriteria, dengan metode:</p> <p>I. Best subset regression</p> <p>II. Backward, Forward, Stepwise</p>	<p>Tugas latihan soal <i>Assignments of practice questions</i></p>	<p>Ceramah interaktif, Latihan, diskusi <i>Interactive Lectures, Exercises, and Discussions</i></p> <p><b>TM: 2x3x50"</b> <b>PT: 2x3x60"</b> <b>BM: 2x3x60"</b></p>		<p>Pemodelan untuk menanggulangi multikolinieritas dan seleksi model terbaik [Pustaka 1]</p> <p><i>Modeling to overcome multicollinearity and selection of the best model [Reference 1]</i></p>	15%/90%

	<p>software. [Sub CPMK 4.1]</p>	<p>a. Able to understand multicollinearity, detect it with VIF and understand related terminology (ill conditioning, centering scaling) and make a regression model with the Ridge (Gulud) method</p> <p>b. Be able to form a simple orthogonal polynomial regression model</p> <p>c. Able to select between regression models and determine the best according to the criteria, using the following methods: I. Best subset regression II. Backward, Forward, Stepwise</p>					
15	<p>Mampu membuat model regresi nonlinier secara manual maupun software. [Sub CPMK 4.2]</p> <p><i>Able to make nonlinear regression models manually or software.</i> [Sub CPMK 4.2]</p>	<p>a. Dapat membedakan regresi non linier dengan regresi non linier yang dapat dilinierkan.</p> <p>b. Mampu membuat model non linier dengan perhitungan penaksir parameter secara numerik, dengan metode Gauss Newton</p> <p>a. <i>Can distinguish non-linear regression with linearized non-linear</i></p>	<p>Tugas latihan soal <i>Assignments of practice questions</i></p>	<p>Ceramah interaktif, Latihan, diskusi</p> <p><i>Interactive Lectures, Exercises, and Discussions</i></p> <p><b>TM: 1x3x50"</b> <b>PT: 1x3x60"</b> <b>BM: 1x3x60"</b></p>		<p>Penaksiran parameter model regresi non linier [Pustaka 1]</p> <p><i>Estimation of nonlinear regression model parameters [Reference 1]</i></p>	10%/100%

		<i>regression.</i> <i>b. Able to make non-linear models by calculating parameter estimates numerically, using the Gauss Newton method</i>					
<b>16</b>	<b>Evaluasi Akhir Semester / Ujian Akhir Semester/<i>Final Exam</i></b>						

