MODULE HANDBOOK

COMPUTATIONAL STATISTICS

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

ENDORSEMENT PAGE

	MODULE HANDBOOK **COMPUTATIONAL STATISTICS** **STATISTICS UNDERGRADUATE PROGRAM** **DEPARTMENT OF STATISTICS** **INSTITUT TEKNOLOGI SEPULUH NOPEMBER**

Proses *Process*	Penanggung Jawab *Person in Charge*			Tanggal *Date*
	Nama *Name*	Jabatan *Position*	Tanda tangan *Signature*	
Perumus *Preparation*	Prof. Dr.rer.pol. Heri Kuswanto, M.Si	Dosen Lecturer		
Pemeriksa dan Pengendalian *Review and Control*	Prof. Dr.rer.pol. Heri Kuswanto, M.Si; Dr. Irhamah, M.Si	Tim kurikulum Curriculum team		
Persetujuan *Approval*	Prof. Nur Iriawan, MIKom., Ph.D	Koordinator RMK Course Cluster Coordinator		
Penetapan *Determination*	Dr. Kartika Fithriasari, M.Si	Kepala Departemen Head of Department		

MODULE HANDBOOK
COMPUTATIONAL STATISTICS

Module name	COMPUTATIONAL STATISTICS	
Module level	Undergraduate	
Code	SS234206	
Course (if applicable)	COMPUTATIONAL STATISTICS	
Semester	2	
Person responsible for the module	Dr. Irhamah	
Lecturer	Dr. Kartika Fithriasari; Dr. Irhamah; Prof. Heri Kuswanto; Adatul Mukarromah, M.Si.; Shofi Andari, Ph.D.; Dr. Achmad Choiruddin; Novri Suhermi, M.Sc.; Neni A. Firdausanti, Ph.D.	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergradute degree program, mandatory, 2nd semester.	
Type of teaching, contact hours	Lectures, <50 student	
Workload	1. Lectures [L]: 3 x 50 = 150 minutes per week. 2. Practicum [P]: 1x170=170 minutes per week. 3. Exercises and Assignments [EA] : 3 x 60 = 180 minutes (3 hours) per week. 4. Independent learning [IL]: 3 x 60 = 180 minutes (3 hours) per week.	
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	CLO.1 Able to explain the structure of R and Python programming CLO.2 Be able to explain the basics of descriptive statistics program algorithms and implement them in the Statistics package program CLO.3 Be able to explain the basics of computational program algorithms for parameter estimation of one, two and k populations as well implement it in the Statistics package program CLO.4 Be able to explain the basic algorithms of linear and non-linear regression analysis computational programs as well as checking error assumptions and implement them in the Statistics package program	PLO-4 PLO-4 PLO-7 PLO-7 PLO-8

	CLO.5 Able to understand basic program algorithms for computational bootstrap and jacknife regression and implement them in the Statistics package program CLO.6 Able to understand the basic random number generation algorithm and implement it in the Statistics package program CLO.7 Able to communicate effectively and work together in interdisciplinary and multidisciplinary teams	
Content	This course aims to equip students with R and Python programming skills and then formulate problem solving using the basics of computational algorithms for statistical methods. This course focuses on the role of computing as a fundamental tool in data analysis, statistical inference, and for the development of statistical theories and methods. The material is delivered through interactive lectures, discussions, exercises, practicums and Problem Based Learning (PBL).	
Assessment and its weight	Project 1(27%) Cognitive - Midterm Exam (23%) Assignment of programming (27%) Cognitive - Final Exam(23%)	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom	
Reading list	1. Rizzo, M. L. 2017. Statistical Computing with R. Chapman dan Hall/ CRC Computer Science dan Data Analysis. 2. Halswanter, T. 2022. An Introduction to Statistics with Python. Springer 3. Manly, B. F. J. 1997. Randomization, Bootstrap and Monte Carlo Method in Biology. London : Chapman and Hall. 4. Efron, B. and Tibshirani, R. J. 1993. An Introduction to the Bootstrap. Chapman and Hall, Inc.	

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

RENCANA PEMBELAJARAN SEMESTER/
SEMESTER LEARNING PLAN

MATA KULIAH (MK)/ *Course*	**KODE/** *Code*	**Rumpun MK/** *Course Group*	**BOBOT (sks)/** *Weight (credit)*		**SEMESTER/** *Semester*	**Tgl Penyusunan/** *Drafting Date*
KOMPUTASI STATISTIKA/ ***COMPUTATIONAL STATISTICS***	SS234206	SKSD	**T=3**	**P=1**	II	14 Februari 2025

OTORISASI/ *AUTHORIZATION*	**Pengembang RPS/** *RPS Developer*	**Koordinator RMK/** *Course Group Coordinator*	**Ketua PRODI/** *Head of Program*
	Dr. Kartika F.; Dr. Irhamah; Prof. Heri Kuswanto; Adatul M., M.Si.; Shofi Andari, Ph.D.; Dr. A. Choiruddin; Novri Suhermi, M.Sc.; Neni A. F., Ph.D.	Prof. Nur Iriawan	Shofi Andari, Ph.D.

Capaian Pembelajaran (CP)/ *Learning Achievement*		
	CPL-PRODI yang dibebankan pada MK/ ***PLO***	
	CPL-4	Mampu menerapkan Sains dan Matematika untuk mendukung pemahaman metode statistika
	CPL-7	Mampu menggunakan perangkat komputasi modern untuk menyelesaikan permasalahan statistik
	CPL-8	Mampu menggunakan teknik komputasi untuk menyelesaikan permasalahan statistik
	PLO-4	*Able to apply science and mathematics to support the understanding of statistical methods*
	PLO-7	*Able to use modern computing devices to solve statistical problems*
	PLO-8	*Able to use computational techniques to solve statistical problems*
	Capaian Pembelajaran Mata Kuliah (CPMK)/ ***CLO***	
	CPMK-1	Mampu menjelaskan struktur pemrograman R dan Python
	CPMK-2	Mampu menjelaskan dasar-dasar algoritma program statistika deskriptif dan mengimplementasikannya dalam program paket Statistika
	CPMK-3	Mampu menjelaskan dasar-dasar algoritma program komputasi pendugaan parameter satu, dua dan *k* populasi serta mengimplementasikannya dalam program paket Statistika
	CPMK-4	Mampu menjelaskan dasar algoritma program komputasi analisis regresi linier dan non linier serta pemeriksaan asumsi error

dan meng- implementasikannya dalam program paket Statistika

CPMK-5 Mampu memahami dasar algoritma program untuk komputasi regresi bootstrap dan jacknife dan meng-implementasikannya dalam program paket Statistika

CPMK-6 Mampu memahami dasar algoritma pembangkitan bilangan acak dan mengimplementasikannya dalam program paket Statistika

CPMK-7 Mampu berkomunikasi secara efektif dan bekerjasama dalam tim yang interdisiplin dan multidisiplin

CLO-1 Able to explain the structure of R and Python programming

CLO-2 Be able to explain the basics of descriptive statistics program algorithms and implement them in the Statistics package program

CLO-3 Be able to explain the basics of computational program algorithms for parameter estimation of one, two and k populations as well implement it in the Statistics package program

CLO-4 Be able to explain the basic algorithms of linear and non-linear regression analysis computational programs as well as checking error assumptions and implement them in the Statistics package program

CLO-5 Able to understand basic program algorithms for computational bootstrap and Jackniffe regression and implement them in the Statistics package program

CLO-6 Able to understand the basic random number generation algorithm and implement it in the Statistics package program

CLO-7 Able to communicate effectively and work together in interdisciplinary and multidisciplinary teams

Matriks CPL – CPMK

PLO-CLO Matrix

CPMK/*CLO*	CPL-4	CPL-7	CPL-8
CPMK-1/*CLO-1*	√		
CPMK-2/*CLO-2*	√	√	
CPMK-3/*CLO-3*		√	√
CPMK-4/*CLO-4*		√	√
CPMK-5/*CLO-5*		√	√
CPMK-6/*CLO-6*		√	√
CPMK-7/*CLO-7*		√	√

Deskripsi Singkat MK/
Course Description

Mata kuliah ini bertujuan untuk membekali mahasiswa dengan kemampuan pemrograman untuk memformulasikan penyelesaian masalah statistika menggunakan dasar-dasar algoritma dan komputasi. Mata kuliah ini menitikberatkan pada peranan komputasi sebagai alat fundamental dalam analisis data, statistika inferensia, dan pemahaman teori dan metode statistika. Materi disampaikan melalui ceramah interaktif, diskusi, latihan, praktikum serta Problem Based Learning. Tools utama dalam mata kuliah ini yaitu R dan Python.

This course aims to equip students with R and Python programming skills and then formulate problem solving using the basics of

	computational algorithms for statistical methods. This course focuses on the role of computing as a fundamental tool in data analysis, statistical inference, and for the development of statistical theories and methods. The material is delivered through interactive lectures, discussions, exercises, practicums and Problem Based Learning (PBL).
Bahan Kajian: Materi Pembelajaran/ ***Course Material***	Dasar Sains, Teori Statistika, Pengumpulan Data, Deskripsi dan Eksplorasi, Komputasi dan Data Processing, Pemodelan, Industri dan Bisnis, Pemerintahan dan Kependudukan, Ekonomi dan Manajemen, Kesehatan dan Lingkungan *Basic Science, Statistical Theory, Data Collection, Description and Exploration, Computing and Data Processing, Modeling, Industry and Business, Government and Population, Economics and Management, Health and Environment*
Pustaka/ ***References***	**Utama/*Primary*:** 5. Rizzo, M. L. 2017. Statistical Computing with R. Chapman dan Hall/ CRC Computer Science dan Data Analysis. 6. Halswanter, T. 2022. An Introduction to Statistics with Python. Springer **Pendukung/*Secondary* :** 1. Manly, B. F. J. 1997. Randomization, Bootstrap and Monte Carlo Method in Biology. London : Chapman and Hall. 2. Efron, B. and Tibshirani, R. J. 1993. An Introduction to the Bootstrap. Chapman and Hall, Inc.
Dosen Pengampu/ ***Lecturers***	Dr. Kartika Fithriasari; Dr. Irhamah; Prof. Dr.rer.pol. Heri Kuswanto, M.Si; M.Si; Adatul Mukarromah, M.Si; Shofi Andari, Ph.D; Dr. Achmad Choiruddin; Novri Suhermi, M.Sc.; Neni Alya Firdausanti, Ph.D; Muhamad Syukron, S.Stat, MAI; Rahmatin Nur Amalia, S.Stat., M.Si.; Dea Saraswati Pramaningrum, S.Stat., M.Stat.
Matakuliah syarat/ ***Pre-requisite Course***	Pengantar Metode Statistika, Pemrograman Komputer *Introduction to Statistical Methods, Computer Programming*

Mg Ke- ***Week***	**Kemampuan akhir tiap tahapan belajar (Sub-CPMK)** ***Final capability for each learning step***	**Penilaian** ***Evaluation***		**Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]** ***Learning Format Learning Methods Assignment for Student [Estimated Time]***		**Materi Pembelajaran [Pustaka]** ***Learning Material [References]***	**Bobot Penilaian (%)** ***Evaluation Weight (%)***
		Indikator ***Indicator***	**Kriteria & Bentuk** ***Criteria and Format***	**Luring** ***Offline***	**Daring** ***Online***		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1-2	Mampu menjelaskan struktur pemrograman R	1.1 Mampu membaca data dari berbagai	Tugas, Observasi di kelas	Ceramah Interaktif, Diskusi, Latihan Soal		Pengantar Pemrograman R: - Menjalankan R	5%/5%

	Able to explain the structure of R programming	tipe file 1.2 Dapat menjelaskan struktur pemrograman R *1.1 Able to read data from various file types* *1.2 Can explain the programming structure of R*	*Task,* *Observation in class*	Praktikum *Interactive Lectures,* *Discussions,* *Exercises* *Practice* **TM: 2x3x50"** **PT: 2x3x60"** **BM: 2x3x60"** **P: 2x1x170"**		- Struktur data R - Membaca data - Manajemen data - Function di R (termasuk built-in function) - Conditional statement dalam R - Looping *Introduction to R Programming* *- Running R and Python* *- R data structure* *- Read data* *- Data management* *- Functions in R (including built-in functions)* *- Conditional statements* *- Looping*	
3-4	Mampu menjelaskan dasar-dasar algoritma program statistika deskriptif dan mengimplementasikan -nya dalam program paket Statistika *Able to explain the basics of descriptive statistics program algorithms and implement them in the Statistics package program*	Mampu membuat program untuk komputasi statistika deskriptif menggunakan program R *Able to create programs for statistical computationally using R programs*	Tugas, Observasi di kelas Tes Presentasi Makalah *Task,* *Observation in class* *Test*	Ceramah Interaktif, Diskusi, PBL Praktikum *Interactive Lectures,* *Discussions,* *PBL* *Practice* **TM: 2x3x50"** **PT: 2x3x60"** **BM: 2x3x60"** **P: 2x1x170"**		Komputasi Statistika Deskriptif menggunakan R, antara lain: - kovarian/ korelasi - determinan - Grafik *Descriptive Statistical Computing using R:* *- Covariance / correlation* *- Determinants* *- Graphics*	15%/20%

5-6	Mampu menjelaskan dasar-dasar algoritma program komputasi pendugaan parameter satu, dua dan *k* populasi serta mengimplementasi kannya dalam program paket Statistika *Able to explain the basics of computational program algorithms estimating one, two and k populations parameters as well as implementing them in the Statistics package program*	Mampu membuat program untuk komputasi pendugaan dan pengujian parameter satu, dua dan *k* populasi menggunakan R *Able to formulate basic computational approach in R to estimate and test for parameters on one, two and k populations*	Tugas, Observasi di kelas Tes Presentasi Makalah *Task,* *Observation in class* *Test*	Ceramah Interaktif, Diskusi, PBL Praktikum *Interactive Lectures,* *Discussions,* *PBL* *Practice* **TM: 2x3x50"** **PT: 2x3x60"** **BM: 2x3x60"** **P: 2x1x170"**		Komputasi Pendugaan dan Pengujian Parameter Satu, Dua dan *k* Populasi menggunakan R - Stat uji - P-value (termasuk menghitung peluang menggunakan metode numerik) - Selang kepercayaan *Computational Estimation and Testing of Parameters One, Two and k Populations using R*	15%/35%
7	Mampu menjelaskan dasar algoritma program komputasi analisis regresi linier, uji signifikansi parameter regresi dan mengimplementasikan nya dalam program paket Statistika *Able to explain the basic algorithms of linear regression analysis*	Mampu membuat program untuk komputasi analisis regresi linear sederhana serta pengujian hipotesis parameter regresi menggunakan R *Able to make programs for computing simple linear regression analysis computing programs as well as*	Tugas, Observasi di kelas Tes Presentasi Makalah *Task,* *Observation in class* *Test*	Ceramah Interaktif, Diskusi, PBL Praktikum *Interactive Lectures,* *Discussions,* *PBL* *Practice* **TM: 1x3x50"** **PT: 1x3x60"** **BM: 1x3x60"** **P: 1x1x170"**		Komputasi analisis regresi linear sederhana menggunakan R *Computation of simple linear regression analysis using R*	15%/50%

	computing programs as well as regression parameter hypothesis testing and implement them in the Statistics package program	*regression parameter hypothesis testing using R*					
8	**ETS/*Midterm***						
9	Mampu menjelaskan struktur pemrograman Python *Able to explain the structure of Python language programming*	1.3 Mampu membaca data dari berbagai tipe file 1.4 Dapat menjelaskan struktur pemrograman python *1.3 Able to read data from various file types* *1.4 Can explain the programming structure of python*	Tugas, Observasi di kelas *Task, Observation in class*	Ceramah Interaktif, Diskusi, Latihan Soal Praktikum *Interactive Lectures, Discussions, Exercises Practice* **TM: 1x3x50"** **PT: 1x3x60"** **BM: 1x3x60"** **P: 1x1x170"**		Pengantar Pemrograman python: - Menjalankan python - Struktur data di python - Membaca data - Manajemen data - Condiitional statement - Looping - Function (termasuk built-in function) *Introduction to python Programming* *- Running Python* *- data structure in python* *- Reading data* *- Data management* *- Conditional statements* *- Looping* *- Functions*	5%/55%
10 – 11	Mampu menjelaskan dasar algoritma program komputasi analisis regresi linier berganda	Mampu membuat program untuk komputasi analisis regresi linear berganda serta	Tugas, Observasi di kelas Tes Presentasi Makalah	Ceramah Interaktif, PBL Praktikum *Interactive*		Komputasi analisis regresi linear sederhana dan berganda menggunakan Python	15%/70%

	serta pengujian hipotesis parameter regresi dan mengimplementasikannya dalam program paket Statistika *Able to explain the basic algorithms of simple and multiple linear regression analysis computing programs as well as regression parameter hypothesis testing and implement them in the Statistics package program*	pengujian hipotesis parameter regresi menggunakan Python *Able to make programs for computing simple and multiple linear regression analysis computing programs as well as regression parameter hypothesis testing using Python*	*Task,* *Observation in class* *Test* *Presentation* *Paper*	*Lectures,* *Discussions,* *PBL* *Practice* **TM: 2x3x50"** **PT: 2x3x60"** **BM: 2x3x60"** **P: 2x1x170"**		*Computation of simple and multiple linear regression analysis using Python*	
12-13	Mampu memahami dasar algoritma program untuk komputasi regresi bootstrap dan jacknife berbasis pengamatan dan residual serta mengimplementasikannya dalam program paket Statistika *Able to understand the basic algorithms of programs for bootstrap*	Mampu membuat program untuk komputasi regresi bootstrap dan jacknife berbasis pengamatan dan residual menggunakan Python *Able to write programs for bootstrap and jackknife regression computing using R and python*	Tugas, Observasi di kelas Tes *Task,* *Observation in class* *Test* *Presentation* *Paper*	Ceramah Interaktif, PBL Praktikum *Interactive Lectures,* *Discussions,* *PBL* *Practice* **TM: 2x3x50"** **PT: 2x3x60"** **BM: 2x3x60"** **P: 2x1x170"**		Komputasi Regresi bootstrap dan jackknife: - Berbasis pengamatan - Berbasis residual menggunakan Python *Regression computation bootstrap and jackknife:* *- Observation based* *- Residual based using python*	20%/90%

	and jackknife regression computing and implement them in the Statistics package program						
14-15	Mampu memahami dasar algoritma pembangkitan bilangan acak dan mengimplementasikannya dalam program paket Statistika *Able to understand the basis of random number generation algorithms and implement them in the Statistics package program*	a. Mampu menjelaskan algoritma pembangkitan bilangan acak dan mengimplementasikannya dalam program Python b. Mampu membedakan antara metode *Inverse* dan *Acceptance-Rejection* a. *Able to explain random number generation algorithm and implement it in python programs* b. *Able to distinguish between Inverse and Acceptance-Rejection methods*	Tugas, Observasi di kelas Tes *Task, Observation in class Test*	Ceramah Interaktif, PBL Praktikum *Interactive Lectures, Discussions, PBL Practice* **TM: 2x3x50"** **PT: 2x3x60"** **BM: 2x3x60"** **P: 2x1x170"**		Pembangkitan bilangan acak - Metode Invers - Metode Acceptance Rejection menggunakan python *Random number Generation* *- Inverse Method* *- Acceptance method Rejection using python*	10%/100 %
16	EAS/***Final Exam***						

	RENCANA ASESMEN & EVALUASI *Assesment and Evaluation Plan* Program Studi Sarjana Statistika / *Statistics Undergraduate Program* **KOMPUTASI STATISTIKA /** *COMPUTATIONAL STATISTICS*		**RA&E** SLK-06
Kode MK: SS234206 *Course Code: SS234206*	**Bobot sks (T/P):** 4 *CREDITS : 4*	**Rumpun MK:** Statistika Komputasi dan Sains Data *Course cluster: Computational Statistics and Data Science*	Smt: II *Semester II*
OTORISASI *AUTHORIZATION*	**Penyusun** *Author*	**Koordinator RMK** *Coordinator of course cluster*	**Kaprodi** *Head of Department* Dr.rer.pol. Dedy Dwi Prastyo, M.Si.

Mg ke (1)	Sub CP-MK (2)		Bentuk Asesmen (Penilaian) / Evaluation Type (3)	Bobot / Scoring (%) (4)
	No	Kemampuan akhir / Final Capability		
1	CPMK-1	Mampu menjelaskan struktur pemrograman R dan Python	Tuliskan bentuk Tugas, Observasi di kelas Tes *Task,* *Observation in class* *Test*	
2	CPMK-2	Mampu menjelaskan dasar-dasar algoritma program statistika deskriptif dan mengimplementasikannya dalam program paket Statistika	Tugas, Observasi di kelas Tes *Task,* *Observation in class* *Test*	
3	CPMK-3	Mampu menjelaskan dasar-dasar algoritma program komputasi pendugaan parameter satu, dua dan *k* populasi serta mengimplementasikannya dalam program paket Statistika	Tugas, Observasi di kelas Tes *Task,* *Observation in class* *Test*	
4	CPMK-4	Mampu menjelaskan dasar algoritma program komputasi analisis regresi linier dan non linier serta pemeriksaan asumsi	Tugas, Observasi di kelas Tes	

		error dan meng- implementasikannya dalam program paket Statistika	*Task,* *Observation in class* *Test*	
5	CPMK-5	Mampu memahami dasar algoritma program untuk komputasi regresi bootstrap dan jacknife dan meng-implementasikannya dalam program paket Statistika	Tugas, Observasi di kelas Tes *Task,* *Observation in class* *Test*	
6	CPMK-6	Mampu memahami dasar algoritma pembangkitan bilangan acak dan mengimplementasikannya dalam program paket Statistika	Tugas, Observasi di kelas Tes *Task,* *Observation in class* *Test*	
7	CPMK-7	Mampu berkomunikasi secara efektif dan bekerjasama dalam tim yang interdisiplin dan multidisiplin	Tugas, Observasi di kelas Tes *Task,* *Observation in class* *Test*	
			Total Bobot Penilaian	**100%**