



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

Kode Dokumen

REV-1

RENCANA PEMBELAJARAN SEMESTER

MATA KULIAH (MK)		KODE	Rumpun MK	BOBOT (sks)		SEMESTER	Tgl Penyusunan
Teknik Simulasi Lanjut		SS255212	Statistika Komputasi dan Sains Data	T=3	P=0	II	Agustus 2026
OTORISASI		Pengembang RPS		Koordinator RMK		Kepala PRODI	
		Prof. Drs. Nur Iriawan, M.IKom., Ph.D.		Prof. Drs. Nur Iriawan, M.lkomp, Ph.D		Irhamah, S.Si, M.Si, Ph.D.	
Capaian Pembelajaran (CP) <i>Learning Outcome (LO)</i>	CPL-PRODI yang dibebankan pada MK						
	CPL-1 <i>PLO-1</i>	Mampu menunjukkan sikap dan karakter yang mencerminkan: ketakwaan kepada Tuhan Yang Maha Esa, etika dan integritas, berbudi pekerti luhur, peka dan peduli terhadap masalah sosial dan lingkungan, menghargai perbedaan budaya dan kemajemukan, menjunjung tinggi penegakan hukum mendahulukan kepentingan bangsa dan masyarakat luas, melalui kreatifitas dan inovasi, ekselensi, kepemimpinan yang kuat, sinergi, dan potensi lain yang dimiliki untuk mencapai hasil yang maksimal. <i>Able to demonstrate attitudes and characters that reflect: being pious to God Almighty, having ethics and integrity, virtuous character, sensitive and concern with social and environmental issues, respecting cultural differences and pluralism, upholding law enforcement, prioritizing the interests of the nation and the wider community, through creativity and innovation, excellence, strong leadership, synergy, and other potentials to achieve maximum results.</i>					
	CPL-2 <i>PLO-2</i>	Mampu mengembangkan dan memecahkan permasalahan ilmu pengetahuan dan teknologi dalam bidang keilmuan nya melalui riset dengan pendekatan inter atau multidisiplin hingga menghasilkan karya inovatif dan teruji dalam bentuk tesis dan makalah yang telah diterima di jurnal ilmiah nasional terakreditasi atau diterima di seminar internasional bereputasi. <i>Able to develop and solve science and technology problems in their field through research with an inter or multidisciplinary approach to produce innovative and tested works in the form of theses and papers that have been accepted in accredited national journals or accepted at reputable international seminars.</i>					
	CPL-3 <i>PLO-3</i>	Mampu mengelola pembelajaran diri sendiri, dan mengembangkan diri sebagai pribadi pembelajar sepanjang hayat untuk bersaing di tingkat nasional, maupun internasional, dalam rangka berkontribusi nyata untuk menyelesaikan masalah dengan mengimplementasikan teknologi informasi dan komunikasi dan memperhatikan prinsip keberlanjutan. <i>Able to manage their own learning and develop themselves as personal lifelong learners to compete at national and international levels, in order to make a real contribution to solving problems by implementing information and communication technology and paying attention to the principle of sustainability.</i>					
	CPL-4 <i>PLO-4</i>	Mampu menganalisis dan mengintegrasikan Teori Statistika dalam merumuskan metode statistika yang inovatif untuk menyelesaikan permasalahan teoritis dan riil. <i>Able to analyze and integrate statistical theory to formulate innovative statistical methods for solving both theoretical and real-world problems.</i>					

	CPL-5 <i>PLO-5</i>	Mampu merancang, melaksanakan, dan mengevaluasi metodologi pengumpulan data terstruktur dan tidak terstruktur, serta modifikasi metode sampling dan pengumpulan data. <i>Able to design, implement, and evaluate methodologies for collecting both structured and unstructured data, including the modification of sampling and data-collection methods.</i>
	CPL-6 <i>PLO-6</i>	Mampu mengintegrasikan perangkat komputasi modern untuk mengembangkan solusi statistik yang efisien, dengan mengevaluasi keandalan dan ketepatan hasil komputasi. <i>Able to integrate modern computing tools to develop efficient statistical solutions, while assessing the reliability and accuracy of computational results.</i>
	CPL-7 <i>PLO-7</i>	Mampu menganalisis dan mengevaluasi teknik komputasi statistik untuk memecahkan permasalahan statistika yang kompleks berbasis data <i>Able to analyze and evaluate statistical computing techniques to address complex, data-driven statistical problems</i>
	CPL-8 <i>PLO-8</i>	Mampu menganalisis dan mengevaluasi metode statistika untuk merumuskan solusi pada permasalahan teoritis dan riil dengan pendekatan multidisipliner <i>Able to analyze and evaluate statistical methodologies to formulate solutions for theoretical and real-world problems using a multidisciplinary approach.</i>
	CPL-9 <i>PLO-9</i>	Mampu menganalisis dan mengevaluasi metode statistika berbasis komputasi atau analitik yang inovatif untuk mengatasi permasalahan riil di bidang bisnis, industri, ekonomi, finansial, sosial dan pembangunan berkelanjutan, lingkungan, kesehatan, serta mengevaluasi dampaknya terhadap pengambilan keputusan <i>Able to analyze and evaluate innovative computation- or analytics-based statistical methods to address real-world problems in business, industry, economics and finance, social and sustainable development, environment, and health, and to assess their impact on decision-making.</i>
Capaian Pembelajaran Mata Kuliah (CPMK)		
	CPMK-1	Mampu merumuskan dan mengonseptualisasikan penggunaan Teknik Simulasi dan prosedurnya secara mendalam pada berbagai bidang kompleks <i>Able to formulate and conceptualize the advanced application of Simulation Technique concepts and procedures across complex domains</i>
	CPMK-2	Mampu menganalisis, memvalidasi, dan menginterpretasikan data menggunakan metode statistika tingkat lanjut serta kerangka Teknik Simulasi <i>Able to analyze, validate, and interpret data using advanced statistical methods and Simulation Technique frameworks</i>
	CPMK-3	Mampu mendesain, memformulasi, dan menyelesaikan permasalahan statistika tingkat lanjut pada berbagai bidang terapan berbasis Teknik Simulasi <i>Able to design, formulate, and solve advanced statistical problems in various applied fields using Simulation Techniques</i>
	CPMK-4	Mampu mengintegrasikan teknik komputasi mutakhir dan perangkat komputer modern untuk membangun model simulasi yang kompleks <i>Able to integrate cutting-edge computing techniques and modern computer devices required to build complex simulation models</i>
	CPMK-5	Mampu mengevaluasi isu-isu kontemporer serta tren masa depan yang berkaitan dengan perkembangan Teknik Simulasi <i>Able to evaluate contemporary issues and future trends related to Simulation Techniques</i>

	<i>verify its validity; and (ii) conceptualize, execute, and optimize simulation-based experiments to determine the optimal operating conditions of complex real-world systems under uncertainty.</i>
Bahan Kajian: Materi Pembelajaran	Matematika, Teori Statistika, Pengumpulan Data, Deskripsi dan Eksplorasi, Komputasi dan Processing, Pemodelan, Bisnis dan Industri, Pemerintahan dan Kependudukan, Ekonomi dan Manajemen, Kesehatan dan Lingkungan <i>Mathematics, Statistical Theory, Data Collection, Description and Exploration, Computing and Processing, Modeling, Business and Industry, Government and Population, Economics and Management, Health and Environment</i>
Pustaka	Utama :
	1. Voss, J. An introduction to statistical computing : a simulation-based approach, 2014, John Wiley & Sons, New Jersey 2. Rubinstein , R. Y. dan Kroese, D. P. Simulation And the Monte Carlo Method 3rd Edition, 2017, John Wiley & Sons, New Jersey 3. Chen, D. D. dan Chen, J. D. (Editor), Monte-Carlo Simulation-Based Statistical Modeling , 2017. Springer Nature, Singapore 4. Dani, G. Dan Lopes, H. F., Markov chain Monte Carlo: stochastic simulation for Bayesian inference, 2006. Chapman & Hall, New York 5. Møller, J, dan Waagepetersen, R. P.. Statistical inference and simulation for spatial point processes, 2004, Chapman & Hall, London.
	Pendukung :
Dosen Pengampu	Prof. Drs. Nur Iriawan, M.Ikomp, Ph.D
Matakuliah syarat	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuan Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Mampu menjelaskan konsep probabilitas dan distribusi dengan memadukan informasi dari data yang berbeda-beda polanya baik bersifat stokastik ataupun non stokastik <i>Able to explain the concept of probability and</i>	- Pengertian konsep data driven - pdf dan cdf close form - penentuan normalized constant - unimodal dan multimodalitas - plot pola data <i>- Definition of the concept of data driven</i> <i>- Close form pdf and cdf</i>	Observasi Aktifitas di kelas <i>Observation Activities in class</i>	Ceramah Interaktif- Latihan Soal-Praktikum (CILSP) 200 Menit <i>Interactive Lectures- Exercises- Practicum (ILEP) 200 Minutes</i>		Probability review, simulation concepts, data presentation <i>Probability review, simulation concepts, data presentation</i>	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>distribution by combining information from data that have vary patterns either stochastic or non stochastic</i>	- <i>Determination of normalized constant</i> - <i>unimodal and multimodal of pattern data plot</i>					
2 – 3	Mampu menjelaskan cara kerja Random number generation <i>Able to explain how random number generation works</i>	- pembangkitan data random (0,1) (RNG=Random number generator) - pengertian pembuatan random variate generator (RVG) - pembangkitan data random berdistribusi diskrit dan kontinu - <i>Generation of random data (0,1) (RNG=Random number generator)</i> - <i>Definition of executing Random variate generator (RVG)</i> - <i>Random data generation that are discrete and continue distributed</i>	Tes Tugas (Observasi Aktivitas di kelas <i>Assignments (Observation Activities in class</i>	Ceramah Interaktif-Latihan Soal-Praktikum (CILSP) 300 Menit <i>Interactive Lectures-Exercises-Practicum (ILEP) 300 Minutes</i>		Random number generation <i>Random number generation</i> 1.	
4	Mampu menjelaskan teknik Monte Carlo dan mengimplementasikan dalam kalkulus dan penghitungan probabilitas <i>Able to explain Monte Carlo</i>	- penghitungan nilai integral dengan monte carlo - penghitungan nilai probabilitas dengan monte carlo - <i>Calculation of integral values using monte carlo</i>	Presentasi dan diskusi Tugas (Observasi Aktivitas di kelas <i>Presentation and discussion</i>	Ceramah Interaktif-Latihan Soal-Praktikum (CILSP) 200 Menit <i>Interactive</i>		Monte Carlo techniques <i>Monte Carlo techniques</i>	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>techniques and implement in calculus and probability calculation</i>	<i>Calculation of probability values using Monte Carlo</i>	<i>Assignments (Observation Activities in class</i>	<i>Lectures- Exercises- Practicum (ILEP) 200 Minutes</i>			
5	Mampu menjelaskan konsep simulasi melalui proses Bootstrapping and resampling methods <i>Able to explain the concept of simulation through the process of Bootstrapping and resampling methods</i>	perbanyak data versus pembangkitan data dengan resampling untuk menghitung integral dan probabilitas <i>Propagation versus data generation by resampling to calculate integrals and probabilities</i>	Presentasi dan diskusi Tugas (Observasi Aktivitas di kelas <i>Presentation and discussion Assignments (Observation Activities in class</i>	200 menit <i>200 minutes</i>		Bootstrapping and resampling methods <i>Bootstrapping and resampling methods</i>	
6	Mampu menentukan validitas hasil simulasi dengan memilih Statistical tests and model validation yang tepat <i>Able to determine the validity of simulation results by choosing the right Statistical tests and validation models</i>	pengujian validitas RNG dan RVG <i>RNG and RVG validity testing</i>	Presentasi dan diskusi Tugas (Observasi Aktivitas di kelas <i>Presentation and discussion Assignments (Observation Activities in class</i>	Ceramah Interaktif- Latihan Soal-Praktikum (CILSP) 100 Menit <i>Interactive Lectures- Exercises- Practicum (ILEP) 100 Minutes</i>		Statistical tests and model validation <i>Statistical tests and model validation</i>	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
7 – 8	- Mampu menjelaskan dan menentukan Teknik reduksi varians data simulasi yang tepat - ETS - <i>Able to explain and determine the appropriate reduction variance technique of simulation data ETS</i>	Pengendalian besaran varian data yang disimulasikan <i>Controlling the variance of simulated data</i>	Tes Tugas (Observasi Aktifitas di kelas <i>Test Assignments (Observation Activities in class</i>	Ceramah Interaktif- Latihan Soal-Praktikum (CILSP) 100 Menit <i>Interactive Lectures- Exercises- Practicum (ILEP) 100 Minutes</i>		Teknik reduksi varians <i>Variance reduction technique</i>	
9-10	Mampu mejelaskan kemanfaatan interaksi RNG dalam simulasi sistem event diskrit <i>Able to explain the usefulness of RNG interactions in discrete event system simulations</i>	Pembuatan simulator sistem M/M/S <i>M/M/S system simulator execution</i>	Presentasi dan diskusi Tugas (Observasi Aktifitas di kelas <i>Presentation and discussion Assignments (Observation Activities in class</i>	Ceramah Interaktif- Latihan Soal-Praktikum (CILSP) 250 Menit <i>Interactive Lectures- Exercises- Practicum (ILEP) 250 Minutes</i>		Discrete event simulation <i>Discrete event simulation</i>	
11	Mampu menjelaskan konsep dan proses Simulasi stokastik yang berpola	- Simulasi data mixture k komponen distribusi diskrit	Presentasi dan diskusi Tugas	Ceramah Interaktif- Latihan Soal-Praktikum		Mixture models and clustering	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	mixture dan ber-kelompok (cluster) <i>Able to explain the concept and stochastic simulation process that have mixture and pattern and group (cluster)</i>	- Simulasi data mixture k komponen distribusi kontinu <i>- Simulation of mixture k components discrete distribution data</i> <i>Simulation of mixture k continuous distribution component data</i>	(Observasi Aktifitas di kelas <i>Presentation and discussion Assignments (Observation Activities in class)</i>	(CILSP) 175 Menit <i>Interactive Lectures- Exercises- Practicum (ILEP) 175 Minutes</i>		<i>Mixture models and clustering</i>	
12	Mampu menjelaskan konsep dan proses Simulasi proses rantai Markov discrete-time <i>Able to explain the concept and simulation process of the discrete-time Markov chain process</i>	Simulasi pengisian matriks transisi markov ($k \times k$) <i>Simulation of filling the markov transition matrix ($k \times k$)</i>	Presentasi dan diskusi Tugas (Observasi Aktifitas di kelas <i>Presentation and discussion Assignments (Observation Activities in class)</i>	Ceramah Interaktif- Latihan Soal-Praktikum (CILSP) 150 Menit <i>Interactive Lectures- Exercises- Practicum (ILEP) 150 Minutes</i>		Discrete time Markov chains <i>Discrete time Markov chains</i>	
13-14	Mampu menjelaskan kesamaan dan perbedaan konsep dan proses antara metode Markov chain Monte Carlo (MCMC)	- Pengertian EM - Pengertian penggantian proses EM dengan MCMC - <i>Definition of EM</i>	Presentasi dan diskusi Tugas (Observasi Aktifitas di kelas	Ceramah Interaktif- Latihan Soal-Praktikum (CILSP) 300 Menit		Markov chain Monte Carlo methods dan Expectation maximization	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	dengan metode Expectation maximization (EM) <i>Able to explain the similarities and differences in concepts and processes between the Markov chain Monte Carlo (MCMC) method and the Expectation maximization (EM) method</i>	<i>- Definition of the replacement of EM processes with MCMC</i>	<i>Presentation and discussion Assignments (Observation Activities in class)</i>	<i>Interactive Lectures- Exercises- Practicum (ILEP) 300 Minutes</i>		<i>Markov chain Monte Carlo methods and Expectation maximization</i>	
15 – 16	- Mampu menjelaskan konsep MCMC and simulated annealing - EAS <i>- Able to explain the concept of MCMC and simulated annealing</i> - EAS	Pengertian simulated annealing untuk proses MCMC <i>Definition of Simulated annealing for the MCMC process</i>	Presentasi dan diskusi Tugas (Observasi Aktifitas di kelas) <i>Presentation and discussion Assignments (Observation Activities in class)</i>	Ceramah Interaktif- Latihan Soal-Praktikum (CILSP) 125 Menit <i>Interactive Lectures- Exercises- Practicum (ILEP) 125 Minutes</i>		MCMC and simulated annealing <i>MCMC and simulated annealing</i>	