



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
Analisis Bayesian		SS255111	Statistika Komputasi dan Sains Data	T=3	P=0	I	18 Februari 2025
OTORISASI		Pengembang RPS		Koordinator RMK		Kepala PRODI	
		Prof. Drs. Nur Iriawan, M.Ikomp, Ph.D		Prof. Drs. Nur Iriawan, M.Ikomp, Ph.D		Irhamah, S.Si, M.Si, Ph.D.	
Capaian Pembelajaran (CP) <i>Learning Outcome (LO)</i>	CPL-PRODI yang dibebankan pada MK						
	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-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	Memahami konsep berfikir Bayesian, pemilihan prior sesuai dengan pola data, penyusunan posterior dan marjinalisasinya, konsep data augmentation, dan resampling dengan MCMC				
		CPMK-2	Memahami struktur Bayesian untuk distribusi dan pemodelan berbasis normal				
		CPMK-3	Memahami struktur Bavesian untuk pemodelam berstruktur hirarki				

	4. Robert, C. P., 2007, <i>The Bayesian Choice from Decision-Theoretic Foundations to Computational Implementation</i> 2 nd Edition, Springer, New York 5. Hayakawa, Y, Ironi, T, dan Xie, M. (2001) <i>System and Bayesian Reliability</i> . World Scientific, Singapore. 6. Software: WinBUGS 1.4 dan R2WinBUGS.
	Pendukung :
	1. Carlin, B. P. dan Louis, T. A., 1996, <i>Bayes and Empirical Bayes Methods for Data Analysis</i> , Chapman & Hall, London 2. Ntzoufras, N. (2009) <i>Bayesian Modeling Using WinBUGS.</i> , John-Wiley & Sons, New Jersey. 3. Svetlozar T. Rachev, S. T., Hsu, J. S., J., Bagasheva, B., S., dan Fabozzi, F., J., 2008, <i>Bayesian Methods in Finance</i> , John Wiley & Sons, New Jersey 4. Kruschke, J., K., 2010, <i>Doing Bayesian Data Analysis: A Tutorial with R and BUGS</i> , Academic Press / Elsevier 5. McLachlan, G. and Basford, K., 1988, <i>Mixture models: inference and application to clustering</i> , Marcel and Decker Inc. 6. Tanner, M. A., 1996, <i>Tools for Statistical Inference: Methods for the Exploration of Posterior Distributions and Likelihood Functions</i> , 3rd Edition, Springer-Verlag: New York. 7. Box, G. E. P. and Tiao, G. C., 1973, <i>Bayesian Inference in Statistical Analysis</i> , Reading, MA, Addison-Wesley. 8. Casella, G. and Berger, R. L., 1990, <i>Statistical Inference</i> , Duxbury, Belmont California, USA. 9. Zellner, A., 1971, <i>An Introduction to Bayesian Inference in Econometrics</i> , Wiley, New York. 10. Titterton, M., Makov, G., and Smith A.F.M., 1985, <i>Statistical analysis of finite mixtures</i> , John Wiley & Sons, UK. 11. Martz, H.F. and Waller, R. A., 1982, <i>Bayesian Reliability Analysis</i> , John Wiley & Sons, New York 12. Iriawan, N. (2012) <i>Pemodelan dan Analisis Data Driven</i> , ITS Press, Surabaya.
Dosen Pengampu	Prof. Drs. NUR Iriawan, MIKomp., Ph.D.
Matakuliah syarat	

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)
1	1. Mampu menjelaskan konsep berfikir Bayesian dan mengetahui bedanya dengan konsep berfikir frekuentis	1.1. Memahami konsep hukum Bayes 1.2. Memahami perbedaan cara berfikir Bayesian vs frequentist <i>1.1. Understand the Bayes law concepts</i>	Tes tulis Tugas 1 Observasi di kelas <i>Written test Task 1 Observation in class</i>	Ceramah, diskusi dan latihan soal <i>Lectures, discussions and exercises</i> 150 menit <i>150 minutes</i>		Pendahuluan: Teorema Bayes dan Bayesian inference <i>Introduction: Bayes theorems and Bayesian inference</i>	10%/10%

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 (<i>offline</i>)	Daring (<i>online</i>)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Able to explain the concept of Bayesian thinking and know the difference with the concept of frequentist thinking</i>	<i>1.2. Understand the difference between Bayesian vs frequentist thinking</i>				(1) Bab 3 (2) Bab 2 dan Bab 3 (3) Bab 2	
2	2. Memahami konsep prior, pemilihan prior sesuai dengan pola data. <i>Understand the prior concept, prior selection corresponds to data patterns.</i>	2.1. Mampu memilih prior yang tepat untuk sebuah model Bayesian 2.2. Mampu memodelkan fenomena dengan Bayesian 2.3. Mampu menghitung probabilitas posterior suatu event <i>2.1. Able to choose the right prior for a Bayesian model</i> <i>2.2. Able to model phenomena with Bayesian</i> <i>Able to calculate the posterior probability of an event</i>	Tes tulis Tugas 1 Observasi di kelas <i>Written test</i> <i>Task 1</i> <i>Observation in class</i>	Ceramah, diskusi dan latihan soal <i>Lectures, discussions and exercises</i> 150 menit <i>150 minutes</i>		Prior, posterior, dan Bayesodds <i>Prior, posterior, dan Bayesodds</i> (1) Bab 3 (2) Bab 2 dan Bab 3 (3) Bab 2	15%/25%
3 - 4	3. Memahami konsep data augmentation dan resampling dengan MCMC	3.1 Mampu mengimplementasikan model Bayesian dengan MCMC, khususnya Gibbs	Tes tulis Tugas 2 Observasi di kelas <i>Written test</i> <i>Task 2</i>	Ceramah, diskusi dan latihan soal <i>Lectures, discussions and exercises</i>		Data augmentation dan Markov Chain Monte Carlo (MCMC) <i>Data</i>	10%/35%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bentuk 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>Understand the concept of data augmentation and resampling with MCMC</i>	sampler dan Metropolis Hasting 3.2 Mampu menggunakan WinBUGS untuk penyederhanaan pemodelan Bayesian dengan MCMC <i>3.1 Able to implement the Bayesian model with MCMC, in particular Gibbs sampler and Metropolis Hasting</i> <i>3.2 Able to use WinBUGS for simplification of Bayesian modeling with MCMC</i>	<i>Observation in class</i>	300 menit <i>300 minutes</i>		<i>augmentation and Markov Chain Monte Carlo (MCMC)</i> (1) Bab 4 (2) Bab 10, Bab 11, Bab 12, & Bab 13 (3) Bab 5, Bab 6, Bab 10, dan Bab 11 (6)	
5 - 6	4. Mampu menjelaskan struktur posterior untuk single dan multiple parameter yang tersusun secara hierarchy ataupun tidak. <i>Able to explain the posterior structure for single and multiple parameters that</i>	4.1. Mampu membedakan dan memodelkan permasalahan dengan Bayesian single dan multipleparameter 4.2. Mampu mengkonstruksikan pemodelan Bayesian dengan struktur Hierarchy <i>4.1. Able to distinguish and model problems with Bayesian</i>	Tes tulis Tugas 2 Observasi di kelas <i>Written test Task 2 Observation in class</i>	Ceramah, diskusi dan latihan soal <i>Lectures, discussions and exercises</i> 300 menit <i>300 minutes</i>		Single-parameter model dan Multi-parameter model <i>Single-parameter model and Multi-parameter model</i> (1) Bab 3 dan Bab 5 (2) Bab 5, Bab 14, dan Bab 15 (3) Bab 3, Bab 4, dan Bab 7	10%/45%

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)
	<i>are arranged hierarchically or not.</i>	<i>singles and multiple parameters</i> 4.2. <i>Able to construct Bayesian model with Hierarchy structure</i>					
7 - 8	5. Memahami struktur Bayesian untuk distribusi normal <i>Understand Bayesian structures for normal, non-normal or neo-normal distributions</i>	5.1. Mampu membedakan permasalahan normal 5.2. Mampu menyusun, mengimplementasikan model Bayesian normal dengan MCMC <i>5.1. Able to distinguish normal, non-normal, and neo-normal problems</i> <i>5.2. Able to construct, implement normal, non-normal, and neo-normal Bayesian models with MCMC</i>	Tes tulis Tugas 2 Observasi dan presentasi di kelas <i>Written test Task 2 Observations and presentations in class</i>	Ceramah, diskusi, latihan soal, dan presentasi di kelas <i>Lectures, discussions, exercises, and presentations in class</i> 300 menit <i>300 minutes</i>		Bayesian Normal model <i>Bayesian Normal model</i>	10%/55%
9 - 10	6. Memahami struktur Bayesian untuk model reliability <i>Understand Bayesian structures for reliability models</i>	6.1. Memahami konsep probabilitas dan Bayes dalam permasalahan Reliability 6.2. Mampu memodelkan fenomena Bayesian dalam Reliability <i>6.1. Understand the concept of</i>	Tes tulis Tugas 3 Observasi di kelas <i>Written test Task 3 Observation in class</i>	Ceramah, diskusi dan latihan soal <i>Lectures, discussions and exercises</i> 300 menit <i>300 minutes</i>		Bayesian Reliability <i>Bayesian Reliability</i> (5) Bab 16 s/d Bab 22	10%/65%

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>probability and Bayes in reliability problem</i> 6.2. <i>Able to model Bayesian phenomena in Reliability</i>					
11	7. Memahami struktur Bayesian untuk system pemodelan dengan susunan mixture <i>Understand Bayesian structures for modeling systems with mixture arrangements</i>	7.1. Mampu mengidentifikasi permasalahan yang mempunyai struktur model mixture 7.2. Mampu memodelkan fenomena mixture dalam struktur Bayesian 7.3. Mampu menerapkan MCMC dalam penyelesaian Bayesian mixture <i>7.1. Able to identify problems that have a mixture model structure</i> <i>7.2. Able to model mixture phenomena in Bayesian structures</i> <i>7.3. Able to implement MCMC in Bayesian mixture solution</i>	Tes tulis Tugas 4 Observasi di kelas <i>Written test Task 4</i> <i>Observation in class</i>	Ceramah, diskusi dan latihan soal <i>Lectures, discussions and exercises</i> 150 menit <i>150 minutes</i>		Bayesian Mixture Model <i>Bayesian Mixture Model</i> (2) Bab 22	10%/75%

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)
12	8. Mampu menjelaskan konsep struktur Bayesian untuk system pemodelan dengan susunan mixture of mixture <i>Able to explain the concept of Bayesian structure for modeling systems with mixture of mixture arrangements</i>	7.1. Mampu mengidentifikasi permasalahan yang mempunyai struktur model mixture of mixture 7.2. Mampu memodelkan fenomena mixture of mixture dalam struktur Bayesian 7.3. Mampu menerapkan MCMC dalam penyelesaian Bayesian mixture of mixture <i>7.1. Able to identify problems that have a mixture of mixture model structure</i> <i>7.2. Able to model the mixture of mixture phenomena in Bayesian structure</i> <i>7.3. Able to apply MCMC in the Bayesian mixture of mixture solution</i>	Tes tulis Tugas 4 Observasi di kelas <i>Written test Task 4 Observation in class</i>	Ceramah, diskusi, latihan soal, dan presentasi <i>Lectures, discussions, exercises, and presentations</i> 150 menit <i>150 minutes</i>		Bayesian Mixture of mixture <i>Bayesian Mixture of mixture</i> (2) Bab 22	10%/85%
13 - 14	9. Mampu menjelaskan konsep cara pembentukan beberapa alternatif model Bayesian dan memahami cara	8.1 Mampu menyusun model struktur perkalian distribusi 8.2 Mampu menerapkan Bayes faktor dalam pemilihan model	Tes tulis Tugas 4 Observasi di kelas <i>Written test Task 4 Observation in</i>	Ceramah, diskusi dan latihan soal <i>Lectures, discussions and exercises</i>		Pemilihan model terbaik dengan Bayesian <i>Best model selection with Bayesian</i>	5%/90%

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)
	pemilihan model Bayesian terbaik <i>Able to explain the concept of how to form several alternative Bayesian models and understand how to select the best Bayesian model</i>	8.3 Mampu menentukan jumlah komponen mixture dengan MCMC dan reversible jump <i>8.1 Able to construct the structure of multiplication distribution model</i> <i>8.2 Able to apply Bayes factors in the model selection</i> <i>8.3 Able to determine the number of mixture components with MCMC and reversible jump</i>	<i>class</i>	300 menit <i>300 minutes</i>		(1) Bab 6 (2) Bab 6 dan Bab 7	
15	10. Mampu mempresentasikan hasil kerja kelompok dalam proyek Bayesian yang ditugaskan dan memahami alternatif model Bayesian yang paling tepat untuk digunakan <i>Able to present the</i>	Mampu menerapkan dan mempresentasikan hasil Analisis Bayesian untuk menyelesaikan masalah riil dengan menggunakan program WinBUGS, R atau MLWin <i>Able to apply and present Bayesian analysis results to solve real problems using WinBUGS, R or MLWin programs</i>	Tes tulis Tugas 4 Observasi dan Presentasi di kelas <i>Written test Task 4 Observation and Presentation in class</i>	Presentasi dan Diskusi <i>Bayesian Project Presentation</i> 150 menit <i>150 minutes</i>		Presentasi Proyek Bayesian <i>Bayesian Project Presentation</i>	10%/100%

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 (<i>offline</i>)	Daring (<i>online</i>)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>results of team work in assigned Bayesian projects and understand the most appropriate Bayesian model alternatives to use</i>						