	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Data Science Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Probability Theory	4920203004	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	1	August 26, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**	
	PLO-9	Able to apply data science principles to solve problems
	PLO-17	Mastering mathematical and statistical theories related to data science
	Program Objectives (PO)	
	PO - 1	Students are able to explain concepts in statistics and probability theory
	PO - 2	Students are able to explain the concept of statistical measurement
	PO - 3	Students explain the concept of the Axiom of Probability
	PO - 4	Students explain the concept of Conditional Probability
	PO - 5	Able to explain concepts in Random Variables
	PO - 6	Able to explain the concept of Special Random Continuous Variables
	PO - 7	Students explain the concept of Joint Distributed Random Variable
	PO - 8	Students explain the concept of Conditional Probability in Joint Distributed Random Variables
	PLO-PO Matrix	

P.O	PLO-9	PLO-17
PO-1		
PO-2		
PO-3		
PO-4		
PO-5		
PO-6		
PO-7		
PO-8		

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																
PO-2																
PO-3																
PO-4																
PO-5																
PO-6																
PO-7																
PO-8																

Short Course Description	In this course, concepts in probability theory will be studied including analysis of probability axioms, conditional probability, discrete and continuous random variables, basic and conditional probability theory, discrete special random variables (Bernoulli, Binomial, Geometric, Poisson), continuous special random variables (Uniform, Exponential, Normal). In this way, students will have the learning experience to think critically and be able to make the right decisions regarding the use of these concepts.
References	**Main :**
	1. Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.
	Supporters:
	1. Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2012. 2. Probability & Statistics for Engineers & Scientists NINTH EDITION, Ronald E. Walpole, Prentice Hall, 2021.
Supporting lecturer	Dr. Atik Wintarti, M.Kom. Dr. Wiyli Yustanti, S.Si., M.Kom. Harmon Prayogi, M.Sc. Hasanuddin Al-Habib, M.Si. Riskyana Dewi Intan Puspitasari, M.Kom.

Week-	**Final abilities of each learning stage (Sub-PO)**	**Evaluation**		**Help Learning, Learning methods, Student Assignments, [Estimated time]**		**Learning materials [References]**	**Assessment Weight (%)**
		Indicator	**Criteria & Form**	**Offline (*offline*)**	**Online (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students understand concepts in probability theory	1. Able to explain the implementation of statistics and probability theory in solving science data problems 2. Able to explain the concept of descriptive statistics 3. Able to explain the concepts of population and sample	**Criteria:** Non-Test **Form of Assessment** : Participatory Activities	- Presentation - Questions and Answers - Discussion 150 minutes	- LMS Discussion Forum	**Material:** Introduction to Statistics and Data Analysis **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.* **Material:** Introduction to statistics **Library:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.*	2%

2	Students are able to explain the concept of statistical measurement	1. Able to explain the concepts of Discrete Data and Continuous Data 2. Able to explain the concept of statistical data measurement 3. Able to explain the concepts of Sample Mean, Median, Mode 4. Able to explain the concept of sample variance and std 5. Able to explain the concept of sample percentile 6. Able to explain and create Data Visualizations	**Criteria:** Exercises **Form of Assessment** : Test	- Presentation - Questions and Answers - Discussion - Practice Questions 150 minutes		**Material:** Introduction to Statistics and Data Analysis **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.* **Material:** Descriptive statistics. **Bibliography:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.*	5%
3	Students explain the concept of the Axiom of Probability	1. Able to explain the concept of Sample Space and Events 2. Able to explain the concept of the Axiom of Probability 3. Able to explain propositions from probability 4. Able to explain sample space that has the same outcome	**Criteria:** Exercises **Form of Assessment** : Test	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** AXIOMS OF PROBABILITY **Reference:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Probability **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.* **Material:** Elements of probability **Library:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.*	5%
4	Students explain the concept of the Axiom of Probability	1. Able to explain the concept of counting 2. Able to explain the concept of permutation 3. Able to explain the concept of combination	**Criteria:** Exercises **Form of Assessment** : Test	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** COMBINATORIAL ANALYSIS **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.*	5%

5	Students explain the concept of Conditional Probability	1. Able to explain Conditional Probability 2. Able to explain the concept of independent events	**Criteria:** Exercises **Form of Assessment** : Participatory Activities	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** CONDITIONAL PROBABILITY AND INDEPENDENCE **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Probability **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.* **Material:** Elements of probability **Library:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.*	2%
6	Able to explain concepts in Random Variables	1. Able to explain the concept of random variables 2. Able to explain the types of discrete and continuous random variables 3. Able to explain the concept of Probability Mass Function (PMF) 4. Able to explain the concept of Probability Density Function (PDF) 5. Able to explain the concept of Cumulative Distribution Function (CDF)	**Criteria:** Exercises	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Random Variables and Probability Distributions **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.* **Material:** Random variables and expectation **Reference:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.*	5%

7	Able to explain the concept of Expectations	1. Able to explain the concept of Expectations 2. Able to explain the concept of Variant 3. Able to explain the concept of Covariance	**Criteria:** Exercises **Form of Assessment** : Test	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Mathematical Expectation **Library:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.* **Material:** Random variables and expectation **Bibliography:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.*	5%
8	Midterm Exam (UTS)	Able to answer questions correctly	**Criteria:** Exercises **Form of Assessment** : Test	Offline 120 minutes		**Material:** Chapters 1-4 **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Chapters 1-4 **Bibliography:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.* **Material:** Chapters 1-4 **Bibliography:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.*	5%

9	Able to explain the concept of Special Random Discrete Variables	1. Able to explain Random Bernoulli Variables 2. Able to explain Random Binomial Variables	**Criteria:** Exercises **Form of Assessment** : Participatory Activities	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Random Variables and Probability Distributions **Library:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.* **Material:** Special random variables **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.*	2%
10	Able to explain the concept of Special Random Discrete Variables	1. Able to explain Random Geometric Variables 2. Able to explain Random Hypergeometric Variables 3. Able to explain Poisson Random Variables	**Criteria:** Exercises **Form of Assessment** : Participatory Activities	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Random Variables and Probability Distributions **Library:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.* **Material:** Special random variables **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.*	2%

11	Able to explain the concept of Special Random Continuous Variables	1. Able to explain Uniform Random Variables 2. Able to explain Random Exponential Variables	**Criteria:** Exercises **Form of Assessment** : Test	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Random Variables and Probability Distributions **Library:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.* **Material:** Special random variables **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.*	5%
12	Able to explain the concept of Special Random Continuous Variables	1. Able to explain Normal Random Variables 2. Able to explain Random Variable Gamma	**Criteria:** Exercises **Form of Assessment** : Test	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Random Variables and Probability Distributions **Library:** *Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Springer, 20012.* **Material:** Special random variables **Library:** *Introduction to Probability and Statistics for Engineers & Scientists, 6th ed., Sheldon M. Ross, Elsevier, 2021.*	5%

13	Students explain the concept of Joint Distributed Random Variable	1. Able to explain the concept of probability for two discrete random variables 2. Able to explain the concept of probability for two continuous random variables	**Criteria:** Exercises **Form of Assessment** : Participatory Activities	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** JOINTLY DISTRIBUTED RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Random variables and expectation **Bibliography:** *Introduction to Probability and Statistics for Engineers & Scientists, 4th ed., Sheldon M. Ross, Elsevier, 2009.A Modern Introduction to Probability and Statistics, Understanding Why and How, Frederik Michel Dekking et al. , Springer, 2005*	2%
14	Students explain the concept of Joint Distributed Random Variable	1. Able to explain the concept of Expectations in a combination of two random variables 2. Able to explain the concept of Variance in the combination of two random variables 3. Able to explain the concept of Covariance in the combination of two random variables	**Criteria:** Exercises **Form of Assessment** : Participatory Activities, Tests	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** JOINTLY DISTRIBUTED RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Random variables and expectation **Bibliography:** *Introduction to Probability and Statistics for Engineers & Scientists, 4th ed., Sheldon M. Ross, Elsevier, 2009.A Modern Introduction to Probability and Statistics, Understanding Why and How, Frederik Michel Dekking et al. , Springer, 2005*	5%

15	Students explain the concept of Conditional Probability in Joint Distributed Random Variables	1. Students explain the concept of Conditional Probability in Joint Distributed Discrete Random Variables 2. Students explain the concept of Conditional Probability in Joint Distributed Random Continuous Variables	**Criteria:** Practice Case Study Questions from problems that contain the joint distribution of a random variable **Form of Assessment** : Participatory Activities, Portfolio Assessment	- Presentation - Questions and Answers - Practice Questions 150 minutes	LMS Discussion Forum	**Material:** JOINTLY DISTRIBUTED RANDOM VARIABLES **References:** *Ross, Sheldon M, (2020). A First Course in Probability. Tenth Edition, Pearson.* **Material:** Random variables and expectation **Bibliography:** *Introduction to Probability and Statistics for Engineers & Scientists, 4th ed., Sheldon M. Ross, Elsevier, 2009.A Modern Introduction to Probability and Statistics, Understanding Why and How, Frederik Michel Dekking et al. , Springer, 2005*	20%
16	Final Semester Examination (UAS)	Able to answer questions correctly	**Criteria:** Exercises **Form of Assessment** : Test	Offline 120 minutes		**Material:** Meeting material 9-15 **References:** *Introduction to Probability and Statistics for Engineers & Scientists, 4th ed., Sheldon M. Ross, Elsevier, 2009.*	30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	22.5%
2.	Portfolio Assessment	10%
3.	Test	67.5%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.