UNESA	**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
Discrete mathematics	4920203010	Compulsory Study Program Subjects	**T=3**	**P=0**	**ECTS=4.77**	2	January 21, 2024

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-7	Internalize the spirit of independence, struggle and entrepreneurship
PLO-10	Able to use technology in the field of data science
PLO-17	Mastering mathematical and statistical theories related to data science

Program Objectives (PO)	
PO - 1	Students are able to understand the concept of propositional logic and its implementation
PO - 2	Students are able to understand the implementation of equivalence, predicates and quantifiers
PO - 3	Students are able to understand the concepts of proof and mathematical induction
PO - 4	Students are able to understand the concept of sets and functions
PO - 5	Students are able to understand the concepts of notation and counting
PO - 6	Students understand the basic concepts of graphs
PO - 7	Students understand the basic concept of trees

PLO-PO Matrix

P.O	PLO-7	PLO-10	PLO-17
PO-1			
PO-2			
PO-3			
PO-4			
PO-5			
PO-6			
PO-7			

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															✔	✔

Short Course Description	In this course, concepts in discrete mathematics will be studied, including logic, basic discrete structures, and combinatorial analysis, which are the basis for advanced topics and their applications in the field of data science. 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 :**
	Supporters:
	1. Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020 2. Lewis, H, Essential Discrete Mathematics For Computer Science, Princeton University Press, 2019
Supporting lecturer	Dr. Atik Wintarti, M.Kom. Dr. Budi Rahadjeng, S.Si., M.Si. Yuliani Puji Astuti, S.Si., M.Si. Harmon Prayogi, M.Sc. 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 the concept of logic and its implementation	1. Able to explain the concept of propositional logic 2. Able to explain logical operators 3. Be able to explain the truth table 4. Able to distinguish conditional statements 5. Be able to explain the Truth Table 6. Able to implement propositional logic in everyday problems	**Criteria:** Non-Test Assignments **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** Propositional Logic, Conditional Statements, Operations in Propositional Logic, Truth Tables, and Applications of Propositional Logic **:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%
2	Students understand the implementation of equivalence of propositions, predicates and quantifiers	1. Able to explain the concept of predicate logic 2. Able to explain the concept of Universal & Existential quantifiers 3. Able to explain negation in predicate logic formulas 4. Able to explain translation in predicate logic formulas	**Criteria:** Non-Test Assignments **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** Predicate logic, Universal Quantifiers, Existential Quantifiers, Negation in predicate logical formulas, and Translation in predicate logical formulas **References:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%
3	Students understand the concept of nested quantifiers	1. Able to explain the concept of nested quantifiers 2. Able to explain translation in nested predicate logic formulas	**Criteria:** Individual task **Forms of Assessment** : Participatory Activities, Practice/Performance, Tests	Collaborative Learning (Lecture, discussion and question and answer) 3 x 50 minutes		**Material:** Nested quantifiers, translation of quantifiers **References:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%

4	Students understand the concept of inference rules	1. Able to explain the concept of nested quantifiers 2. Able to explain the concept of argument in propositional logic 3. Able to explain the concept of inference rules 4. Able to explain the concepts of Modus Ponens, Modus Tolens, Hypothetical Syllogism, Disjunctive Syllogism, Addition, Simplification, Conjunction, Resolution, Fallacy,	**Criteria:** Non-Test **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** Arguments in propositional logic, Inference rules, Modus Ponens, Modus Tolens, Hypothetical Syllogism, Disjunctive Syllogism, Addition, Simplification, Conjunction, Resolution, Fallacy, **Library:** *Lewis, H, Essential Discrete Mathematics For Computer Science, Princeton University Press, 2019*	5%
5	Students understand the concept of inference rules	Test	**Criteria:** Quiz **Forms of Assessment** : Participatory Activities, Practice/Performance, Tests	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** Inference Rules in Predicate Logic **Bibliography:** *Lewis, H, Essential Discrete Mathematics For Computer Science, Princeton University Press, 2019*	5%
6	Able to understand the concept of proof	1. Able to explain the concepts of Lemma, Theorem, Corollary, Conjecture, 2. Able to explain the concept of Trivial Proof Theorem, Vacuous Proof, Direct Proof, Proof by contraposition, Proof by contradiction, Biconditional Proof, Proof by case, Counterexample	**Criteria:** Non-Test **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** Lemma, Theorem, Corollary, Conjecture, Trivial Proof, Vacuous Proof, Direct Proof, Proof by contraposition, Proof by contradiction, Biconditional Proof, Proof by case, Counterexample **Library:** *Lewis, H, Essential Discrete Mathematics For Computer Science, Princeton University Press, 2019*	5%
7	Students are able to understand the concept of mathematical induction	1. Able to explain the concept of Deductive Proof 2. Able to explain the Principle of Mathematical Induction	**Criteria:** Non-Test Assignments **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** Concept of Deductive Proof, Principles of Mathematical Induction **Bibliography:** *Lewis, H, Essential Discrete Mathematics For Computer Science, Princeton University Press, 2019*	5%
8	Midterm Exam (UTS)	Written Test Exam	**Criteria:** Written Exam **Form of Assessment** : Test	100 minute Offline Written Exam		**Material:** All material before UTS **Library:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	20%

9	Students understand the concept of sets and functions	1. Able to explain the concept of Set 2. Able to explain the concept of Function 3. Able to explain the concept of Arithmetic Sequences 4. Able to explain the concept of Geometric Sequences 5. Able to explain Countability 6. Able to explain Uncountable Sets 7. Be able to explain the concept of Set Cardinality	**Criteria:** Non-Test **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** Sets, Functions, Arithmetic Sequences, Geometric Sequences, Cardinality of Sets, Addition (Summation) **Library:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%
10	Students understand the concept of counting	1. Be able to explain the concept of addition rules 2. Able to explain the concept of multiplication rules 3. Able to explain the concept of permutation 4. Able to explain the concept of combination	**Criteria:** Task **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** addition rules, multiplication rules, permutations and combinations **Reference:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%
11	Students understand the concept of Pigeonhole and binomial	1. Able to explain the concept of the Pigeonhole Principle 2. Able to explain the concept of binomials 3. Able to explain the concept of generalization of permutations 4. Able to explain the concept of generalization of combinations	**Criteria:** Non-Test **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** Pigeonhole Principle, binomials, generalization of permutation, generalization of combinations **References:** *Lewis, H, Essential Discrete Mathematics For Computer Science, Princeton University Press, 2019*	5%

12	Students understand the concept of generating functions	1. Able to explain the concept of generating function 2. Be able to explain the concept of a generating function for a series of binomial coefficients 3. Be able to explain the concept of generating functions for other sequences 4. Be able to explain the properties of generating functions 5. Able to solve recurrence relations with generating functions 6. Able to solve combinatorics problems with generating functions	**Criteria:** Quiz Test **Form of Assessment** : Participatory Activities, Practice/Performance	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** generating functions, generating functions for binomial coefficient sequences, generating functions for other sequences, properties of generating functions, generating functions for recurrence relations with, generating functions for combinatorics problems with **References:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%
13	Students understand the concept of inclusion-exclusion and recursive principles	1. Able to explain the concepts and principles of inclusion-exclusion 2. Able to explain alternative forms of the inclusion-exclusion principle 3. Able to explain the application of the inclusion-exclusion principle 4. Be able to explain the application of the recursive principle	**Criteria:** Participation **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** inclusion-exclusion principles, alternative forms of the inclusion-exclusion principle, application of the inclusion-exclusion principle, recursive form **References:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%
14	Students understand the concept of graphs	1. Able to explain the basic concepts of graphs 2. Able to explain models and types of graphs 3. Able to explain the terminology of graphs 4. Able to explain the representation of graphs 5. Able to solve shotest-path problems 6. Able to explain the concept of planar graphs 7. Able to explain the concept of graph coloring	**Criteria:** Participation **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 X 50 minutes		**Material:** basic graph concepts, models and types of graphs, graph terminology, representation of graphs **Reference:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%

15	Students understand the concept of Tree	1. Able to explain the concept of trees 2. Able to explain the concept of tree traversal 3. Able to explain the concept of Spanning Tree 4. Able to explain the concept of Minimum Spanning Tree	**Criteria:** Non-Test **Form of Assessment** : Participatory Activities	Collaborative Learning (Lecture, discussion and question and answer) 3 x 50 minutes		**Material:** tree concept, tree traversal, Spanning Tree, Minimum Spanning Tree, tree applications **References:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	5%
16	Final Semester Examination (UAS)	Writing test	**Criteria:** Final exams **Form of Assessment** : Test	100 minute Offline Written Exam		**Material:** All material **Library:** *Susanna, S.Epp, Discrete Mathematics with Applications, 5th Edition, Cengage, 2020*	10%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	60.84%
2.	Practice / Performance	5.84%
3.	Test	33.34%
		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.