RENCANA PEMBELAJARAN SEMESTER MATEMATIKA DISKRIT PROGRAM STUDI S1 INFORMATIKA/ S1 TEKNOLOGI INFORMASI/ S1 REKAYASA PERANGKAT LUNAK

FAKULTAS INFORMATIKA UNIVERSITAS TELKOM

Identitas Mata Kuliah	**NAMA MK**	**KODE MK**	**RUMPUN MATA KULIAH**	**BOBOT(SKS)**		**SEMESTER**	**Direvisi**
	Discrete Mathematics	CII1G3	Matematika	3	0	2	
Otoritas	**Pengembang RPS**		**Ketua Kelompok Keahlian**			**Ka PRODI**	
	Muhammad Arzaki		Ema Rachmawati			Niken Dwi Wahyu Cahyani	
Deskripsi Mata Kuliah	ID: Matematika Diskrit memberikan paparan yang rinci terkait struktur diskrit dan sifat-sifatnya yang relevan untuk ilmu komputer. Kuliah ini mendukung materi struktur diskrit yang digunakan pada struktur data dan fondasi relevan lain dalam algoritma. Ada empat topik utama dalam kuliah ini yang berkaitan dengan empat capaian pembelajaran (*course learning outcome*). Topik pertama membahas relasi, fungsi, dan relasi rekurensi homogen sederhana. Mahasiswa mempelajari definisi relasi dan fungsi beserta representasi dan karakteristik matematisnya. Selain itu mahasiswa juga mempelajari relasi rekurensi yang akan digunakan selanjutnya dalam analisis algoritma. Topik kedua terkait matematika kombinatorika. Mahasiswa mempelajari dasar teknik berhitung, prinsip sarang merpati, serta permutasi dan kombinasi beserta perumumannya. Topik ketiga terkait graf dan pohon. Pada topik ini mahasiswa akan mengkaji definisi formal graf, sifat-sifat graf, dan beberapa algoritma graf elementer (pewarnaan simpul, pencarian lintasan terpendek, dan konstruksi pohon perentang minimum). Terakhir, pada topik ke empat mahasiswa mengkaji teori bilangan elementer, yang meliputi keterbagian, faktor persekutuan terbesar dan kelipatan persekutuan terkecil beserta aplikasinya, dan aritmetika modular elementer, serta algoritma yang terkait dengan hal-hal tersebut. EN: Discrete Mathematics provides a rigorous exposure concerning discrete structure and their relevant properties for computer science. This course supports the discrete structure materials used in data structure and other relevant foundations in algorithms. There are four main topics in this course which correspond to four course learning outcomes. The first topic discusses relation, function, and simple homogenous recurrence relation. The students will learn the definition of relation and function as well as their representation and mathematical characteristics. In addition, the students will learn recurrence relation that will be used in algorithm analysis. The second topic is pertaining to combinatorial mathematics. The student will study the basic counting principle, pigeonhole principle, permutations and combinations, as well as their generalization. The third topic is about graph and tree. In this topic the students will be exposed to the formal definition of graph, some properties of graphs, and some elementary graph algorithm (algorithm for solving vertex coloring problem, shortest path problem, and minimum spanning tree problem). Finally, in the last topic the students will learn elementary number theory, which contains the discussion about divisibility, greatest common divisor, least common multiple, and their applications, and elementary modular arithmetic as well as their related algorithms.						

Program Learning Outcomes (PLO) & Course Learning Outcomes	**Program Learning Outcomes (PLO) / CPL PRODI**		
	PLO 3	The students can apply scientific and mathematical methods to solve engineering problems using informatics and computing principle. (S1 IF) The students master theoretical/mathematical concepts needed for solving problems related to information technology. (S1 IT)	
	Course Learning Outcomes (CLO)		**PLO yang di dukung**
	CLO 1	Students can identify the characteristics of relations, functions, and recurrence relations and apply rigorous technique for solving mathematical problem pertaining to such materials.	PLO 3
	CLO 2	Students can identify elementary combinatorial problems and utilize appropriate mathematical methods for solving such problems.	PLO 3
	CLO 3	Students can identify the characteristics of graphs and trees as well as demonstrating the process of several algorithms pertaining to such structures.	PLO 3
	CLO 4	Students can perform elementary calculation pertaining to elementary number theory, such as computing the greatest common divisor, least common multiple, performing Euclid's algorithm and performing elementary modular arithmetic.	PLO 3

Penilaian

ID CLO	Bobot per Bentuk Penilaian (dalam persen)				TOTAL BOBOT PER CLO
	Midterm Exam (UTS)	Final Exam (UAS)	Problem Set (or Online Quiz)	Assignment	
CLO 1	17.50		5.00	2.50	25.00
CLO 2	17.50		5.00	2.50	25.00
CLO 3		17.50	5.00	2.50	25.00
CLO 4		17.50	5.00	2.50	25.00
Total per penilaian	**35.00**	**35.00**	**20.00**	**10.00**	**100.00**

Pustaka	**Utama:**	
	K. H. Rosen, Discrete Mathematics and Its Applications, 8th Edition. McGraw-Hill, 2019.	
	Pustaka Pendukung: -	
	1. S. S. Epp. Discrete Mathematics with Applications, 5th Edition. Brooks/ Cole Cengage Learning, 2018. 2. E. Lehman, T. Leighton, and A. R. Meyer. Mathematics for Computer Science. Lecure notes at MIT, 2017. (Available freely.) 3. T. Jenkyns, B. Stephenson. Fundamentals of Discrete Math for Computer Science. Springer, 2013. (Exercise and problem solving.) 4. K. L. Bogart, R.L. Drysdale, and C. Stein. Discrete Mathematics for Computer Science. Key College Pub., 2006. 5. D. Liben-Nowell. Discrete Mathematics for Computer Science. John Wiley & Sons, 2017. 6. R. Munir, Matematika Diskrit (5th edition [revised]), Informatika, 2012.	
Media Pembelajaran	**Software:**	**Hardware:**
	Python 3 (for recurrence relation, combinatorics, and number theoretic algorithm).	Personal computer/laptop.
TeamTeaching	Muhammad Arzaki, Bambang Ari Wahyudi, Gia Septiana Wulandari	
MatakuliahSyarat	Mathematical Logic, Calculus, Introduction to Programming	
Ambang Batas Kelulusan Mahasiswa	40.01	
Ambang Batas Kelulusan MK	85.00%	

MINGGU KE-	ID CLO	DESKRIPSI SUB CLO	INDIKATOR KETERCAPAIAN CLO	BENTUK ASSESMEN	MATERI	METODE	LUAR JARINGAN (TATAP MUKA)	DALAM JARINGAN (DARING)
1	CLO 1	•The students can correctly represent relations using arrow diagram, ordered pair, matrix, and digraph. •The students can perform elementary set operations on relations.	•Correctness of relations representations. •Correctness of set operations on relations.	•Online quiz for week 1 (at LMS CeLOE).	•Relation definition. •Relation representation: arrow diagram, ordered pair, matrix, digraph. •Set operations on relations. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz.		v

2	CLO 1	•Students can determine whether a binary relation has one of the following properties: reflexive, irreflexive, symmetric, anti-symmetric, asymmetric, or transitive. •Students can determine the composition result of two relations.	•Correctness in determining the properties of a relation as well as their arguments. •Correctness of composition calculation.	•Online quiz for week 2 (at LMS CeLOE).	•Properties of binary relations: reflexive, irreflexive, symmetric, anti-symmetric, asymmetric, and transitive. •Relation composition. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz. •Problem set (optional).		v
3	CLO 1	•Students can represent functions using correct mathematical notations. •Students can determine the properties of functions: injective, surjective, and bijective properties. •Students can compute special functions: floor and ceiling functions.	•Correctness of mathematical notations. •Correctness in determining properties of functions as well as their arguments. •Correctness of special functions calculations.	•Online quiz for week 3 (at LMS CeLOE).	•Function definition. •Function representation: arrow diagram, ordered pairs, and mathematical formulas. •Properties of function: injectivity, surjectivity, and bijectivity. •Special function: floor and ceil. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz.		v
4	CLO 1	•Students can determine a particular term of a recursively defined sequence. •Students can determine the characteristic equation as well as its roots of second order homogeneous linear recurrence relation. •Students can determine the solution of a second order homogenous linear recurrence relation.	•Correctness of calculating the n-*th* term of a recursively defined sequence. •Correctness of determining characteristic equation and its roots. •Correctness of the solution for the linear recurrence relation.	•Online quiz for week 4 (at LMS CeLOE). •Assignment for CLO 1	•Definition of recurrence relation. •Problem modeling using recurrence relation. •Characteristics equation and its roots. •Solution for second- order homogenous linear recurrence relations. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz. •Problem set (optional). •Assignment		v
5	CLO 2	•The student can use basic counting technique to solve elementary counting problems.	•Correctness of final result calculation. •Correctness of the counting methods. •Correctness of counting arguments.	•Online quiz for week 5 (at LMS CeLOE).	•Basic counting techniques: addition rule (sum rule). multiplication rule (product rule), subtraction rule (principle of inclusion-exclusion), and division rule. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz. •Problem set (optional).		v
6	CLO 2	•Students can use pigeonhole principle as well as its generalization to solve combinatorial problems.	•Correctness of final result calculation. •Correctness of the counting methods. •Correctness of counting arguments.	•Online quiz week 6 (at LMS CeLOE).	•Pigeonhole principle and its generalization. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz.		v
7	CLO 2	•The students can use combination, permutation, and their generalization to solve combinatorial problems.	•Correctness of final result calculation. •Correctness of the counting methods. •Correctness of counting arguments.	•Online quiz for week 7 (at LMS CeLOE). •Assignment for CLO 2.	•Permutation and combination. •Generalized permutation and combination. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz. •Problem set (optional). •Assignment.		v
8	CLO 3	•Students can draw a graph based on its formal definition. •Students can determine the subgraph, spanning subgraph, and complement graph of a simple graph. •Students can represent graph using matrices and lists.	•Correctness of graphs' drawing. •Correctness of graph representation in matrices and lists.	•Online quiz for week 8 (at LMS CeLOE).	•Basic graph terminologies: nodes/vertices, edges/arcs, and neighbors. •Handshaking theorem. •Subgraph, spanning subgraph, complementary graph, and graph union. •Graph with special structure (complete graph, circle graph, wheel graph, regular graph, bipartite graph). •Graph representation using matrices and lists. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz.		v
9	CLO 3	•Students can determine whether two graphs are isomorphic or not. •Students can identify connectedness, Euler path/circuit, and Hamilton path/circuit in a graph)	•Correctness of mathematical notation. •Correctness of implementing related theorem. •Clarity of arguments.	•Online quiz for week 9 (at LMS CeLOE).	•Graph isomorphism. •Connectivity. •Euler and Hamilton paths and circuits. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz. •Problem set (optional).		v
10	CLO 3	•Students can determine whether a simple graph is planar or not. •Students can perform vertex coloring in a graph. •Students can use vertex coloring to solve a simple optimization problem. •Students can use Dijkstra's algorithm for determining the shortest path between two vertices in a simple weighted graph.	•Correctness and clarity of proving/refuting whether a graph is planar or not. •Correctness of vertex coloring result in a graph. •Correctness and clarity of Welsh-Powell algorithm utilization for vertex coloring. •Correctness of the result of Dijkstra's algorithm. •Clarity of numerical calculations involved in Dijkstra's algorithm.	•Online quiz for week 10 (at LMS CeLOE).	•Planar graph. •Vertex coloring. •Optimization problem using vertex coloring. •Shortest path problem. •Dijkstra's algorithm. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz.		v
11	CLO 3	•Students can determine whether a graph is a tree or not. •Students can determine the root, internal nodes, and leaves of an m-ary tree. •Student can determine the properties of an m-ary tree.	•Correctness of final answers. •Clarity of arguments.	•Online quiz for week 11 (at LMS CeLOE).	•Tree definition. •Rooted tree. •Properties of m-ary tree. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz.		v
12	CLO 3	•Students can determine the spanning tree of a graph. •Students can determine the minimum spanning tree of a weighted graph.	•Correctness of final answers. •Clarity of arguments or steps of algorithm.	•Online quiz for week 12 (at LMS CeLOE). •Assignment for CLO 3.	•Spanning tree and minimum spanning tree. •Prim's algorithm. •Kruskal's algorithm. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz. •Problem set (optional). •Assignment.		v

13	CLO 4	•Students can determine the divisibility relationship of two integers. •Students can explain the definition of a prime number. •Students can provide prime factorization of a positive integer <100. •Students can represent positive integers in decimal, binary, octal, and hexadecimal notations.	•Correctness of mathematical notations. •Clarity of arguments.	•Online quiz for week 13 (at LMS CeLOE).	•Divisibility. •Prime numbers. •Prime factorization. •Integer representation in decimal, binary, octal, and hexadecimal notations. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz. •Problem set.		v
14	CLO 4	•Students can compute the gcd and lcm of two or more numbers using prime factorization. •Students can compute the gcd of two numbers using Euclid's algorithm. •Students can express gcd of two positive integers as their linear combination. •Students can determine the correctness of a statement involving modular congruence. •Students can perform elementary modular arithmetic. •Students can determine the modular inverse of a number.	•Correctness of mathematical notations. •Clarity of arguments.	•Online quiz for week 14. •Assignment for CLO 4.	•Greatest common divisor. •Least common multiple. •Euclid's algorithm for gcd calculation. •gcd as a linear combination. •Modular congruence. •Modular arithmetic. •Modular inverse. Pustaka: utama. Pendukung: [1], [2].	•Lectures. •Discussion. •Exercise. •Online quiz. •Problem set. •Assignment.		v

Notes:
Ambang Batas Kelulusan Mahasiswa merupakan batas minimal nilai yang harus dicapai mahasiswa untuk setiap CLO pada MK
Ambang Batas Kelulusan Mata Kuliah merupakan batas minimal persentase jumlah mahasiswa dalam satu periode pengajaran yang memperoleh nilai >= Ambang Batas Kelulusan Mahasiswa
Contoh:
Dalam 1 kelas terdapat 50 mahasiswa, dimana 30 diantaranya mendapatkan nilai akhir lebih dari 50,01; 15 mahasiswa memperoleh nilai di bawah 50,00; sementara 5 lainnya memperoleh nilai 50,00
maka persentase untuk 1 CLO pada MK ini sebagai berikut

	di atas ambang batas		sesuai ambang batas		di bawah ambang batas		Status MK	
CLO1	30	60.00%	5	10.00%	15	30.00%	FAILED	karena persentase jumlah mahasiswa yang berada di bawah ambang batas kelulusan lebih dari 14.5%