



Universitas Negeri Surabaya
Faculty of Mathematics and Natural Sciences
Bachelor of Mathematics Education Study Program

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date										
Operations Research	8420202004		T=2	P=0	ECTS=3.18	4	July 17, 2024										
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator											
			Dr. Endah Budi Rahaju, M.Pd.											
Learning model	Case Studies																
Program Learning Outcomes (PLO)	PLO study program that is charged to the course																
	Program Objectives (PO)																
	PLO-PO Matrix																
		P.O															
	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
Short Course Description	Study the basic principles of modeling in Linear Programs, Simplex method, Big M method, Two Phase, Duality, use of computer applications to complete linear programs, and Transportation methods and Assignment methods.																
References	Main :																
	1. Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.																
	Supporters:																
Supporting lecturer	Dr. Endah Budi Rahaju, M.Pd. Yuliani Puji Astuti, S.Si., M.Si. Affiati Oktaviana, S.Si., M.Sc. Novita Vindri Harini, M.Pd.																
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	<p>1. Identifying problems that can be arranged in linear programs (CLO-1) Solving two-variable linear programming problems using graphical methods (CLO-3)</p> <p>2. Determine the variables that make up the linear programming model (CLO-1)</p> <p>3. Developing objective functions and boundary functions in linear programming models (CLO-1)</p>	<p>1.1. Identify problems that can be structured in a linear programming model 3. 4.</p> <p>2. Determine the decision variables that make up the model</p> <p>3. Develop objective functions and constraint functions</p>	<p>Form of Assessment : Participatory Activities</p>	<p>Lectures, Responses and Tutorials. Exercises</p>			5%
2	<p>1. Change the system of inequalities into a system of equations (standard form) by adding a slack or surplus variable (CLO-2)</p>	<p>Developing the standard form of a system of inequalities which is a limiting function in linear programming</p>	<p>Form of Assessment : Participatory Activities</p>	<p>Lectures, Responses and Tutorials</p>			0%
3	<p>1.1. Identify the linear programming model and arrange it into a simplex table (CLO-1) 2. 3.</p> <p>2. Explain the simplex algorithm and use it in finding optimal solutions to linear programming problems (CLO-2)</p>	<p>1.1. Identify linear program models and arrange them in a simplex table. Solve linear programs with more than two variables using the simplex method. 3. Determine the characteristics of a single solution, non-single solution, and not having an optimal solution through observing the simplex table</p> <p>2. Solving linear programs with more than two variables using the simplex method</p>	<p>Form of Assessment : Participatory Activities</p>	<p>Lectures, Responses and Tutorials</p>			0%

4	1.1. Identify the linear programming model and arrange it into a simplex table (CLO-1) 2. 3. 2.Explain the simplex algorithm and use it in finding optimal solutions to linear programming problems (CLO-2)	1. Identify linear programming models and arrange them in simplex tables 2. Solving linear programs with more than two variables using the simplex method 3. Determine the characteristics of a single solution, non-single solution, and not having an optimal solution through observing the simplex table	Form of Assessment : Participatory Activities	Lectures, Responses and Tutorials		Material: Simplex Method References: Ravindran, A R., <i>Operations Research and Management Science</i> , 2008, Taylor & Francis Group.	5%
5	Solving linear programming problems involving artificial variables via the Big-M and Two-Phase method (CLO-3)	Students are able to solve linear programming problems involving artificial variables using the Big-M and Two Phase methods.	Form of Assessment : Participatory Activities	Lectures, Responses and Tutorials		Material: Big-M Method Two Phase Method References: Ravindran, A R., <i>Operations Research and Management Science</i> , 2008, Taylor & Francis Group.	5%
6	Solving linear programming problems involving artificial variables via the Big-M and Two-Phase method (CLO-3)	Students are able to solve linear programming problems involving artificial variables using the Big-M and Two Phase methods.	Form of Assessment : Participatory Activities	Lectures, Responses and Tutorials		Material: Big-M Method Two Phase Method References: Ravindran, A R., <i>Operations Research and Management Science</i> , 2008, Taylor & Francis Group.	5%
7	1. Determining the dual form of a primal simplex problem and solving the dual (CLO-1) 2. Using the solver application in Microsoft Excel to solve the simplex method (CLO-4)	1. Determining the dual form from the primal form and completing the dual 2. Solve the simplex method with the help of the solver application in Microsoft Excel	Criteria: Quantitative and Test Form of Assessment : Participatory Activities	Lectures, Responses and Tutorials		Material: Dual Application Solver References: Ravindran, A R., <i>Operations Research and Management Science</i> , 2008, Taylor & Francis Group.	5%
8			Criteria: Quantitative and Test Form of Assessment : Participatory Activities, Tests			Material: UTS Bibliography: Ravindran, A R., <i>Operations Research and Management Science</i> , 2008, Taylor & Francis Group.	25%

9	Determining the initial solution to the transportation problem (CLO-3)	Students are able to solve early stage transportation problems using the methods: 1. North west corner 2. Minimum cost 3. Vogel's Approximation method	Criteria: Quantitative and Test Form of Assessment : Participatory Activities	Lectures, Responses and Tutorials		Material: Initial solution to transportation problems References: <i>Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.</i>	5%
10	Complete the optimization stage of the transportation method using the stepping stone and Modified Distribution (MoDi) method (CLO-3)	Students are able to determine the optimal solution to transportation problems using the methods: 1. Stepping stone 2. MoDi	Criteria: Quantitative and Test	Lectures, Responses and Tutorials		Material: Optimal solution to transportation problems References: <i>Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.</i>	5%
11	Complete the optimization stage of the transportation method using the stepping stone and Modified Distribution (MoDi) method (CLO-3)	Students are able to determine the optimal solution to transportation problems using the methods: 1. Stepping stone 2. MoDi	Criteria: Quantitative and Test	Lectures, Responses and Tutorials		Material: Optimal solution to transportation problems References: <i>Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.</i>	5%
12	Resolving assignment problems (CLO-3)	Students are able to solve assignment problems using the Hungarian method.	Criteria: Quantitative and Test	Lectures, Responses and Tutorials		Material: Assignment Method Literature: <i>Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.</i>	5%
13	Looking for solutions to specific problems in transportation methods in groups through discussions and presentations of discussion results (CLO-3)	Students are able to determine solutions to specific problems in transportation which include problems: 1. Degeneration 2. Damaged lines 3. Unbalanced 4. Maximum pattern of problems. Assignments include: 5. Maximum pattern 6. Unbalanced problems Through group discussion and presentation methods	Criteria: Quantitative and Test	Lectures, Discussions, presentations		Material: Special issue on transportation methods References: <i>Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.</i>	5%

14	Looking for solutions to specific problems in transportation methods in groups through discussions and presentations of discussion results (CLO-3)	Students are able to determine solutions to specific problems in transportation which include problems: 1. Degeneration 2. Damaged lines 3. Unbalanced 4. Maximum pattern of problems. Assignments include: 5. Maximum pattern 6. Unbalanced problems Through group discussion and presentation methods	Criteria: Quantitative and Test	Lectures, Discussions, presentations		Material: Special issue on transportation methods References: <i>Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.</i>	5%
15	Looking for solutions to specific problems in transportation methods in groups through discussions and presentations of discussion results (CLO-3)	Students are able to determine solutions to specific problems in transportation which include problems: 1. Degeneration 2. Damaged lines 3. Unbalanced 4. Maximum pattern of problems. Assignments include: 5. Maximum pattern 6. Unbalanced problems Through group discussion and presentation methods	Criteria: Quantitative and Test	Lectures, Discussions, presentations		Material: Special issue on transportation methods References: <i>Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.</i>	15%
16	Able to use solution search methods in solving mathematical problems in linear programs which include graphic methods, simplex methods, BigM and Two Phase Methods as well as the concept of Duality. In transportation problems, students are able to use the North West Corner method, Minimum Cost, and Vogel's Approximation Method, Modified Distribution, Stepping Stone to get minimum costs, as well as the Hungarian Method for Assignment Problems.	Correctness of Answer Description	Criteria: Quantitative and Test Form of Assessment : Test			Material: UAS Reference: <i>Ravindran, A R., Operations Research and Management Science, 2008, Taylor & Francis Group.</i>	45%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	42.5%
2.	Test	57.5%
		100%

Notes

- 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.
- 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.
- 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.
- 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.
- 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.