

University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
SFTW122 Operations Research I
Syllabus
2nd Semester 2010/2011
Part A – Course Outline

Compulsory course in Computer Science

Catalog description:

(3-2) 4 credits. Introduction to operations research. Linear programming and simplex method. Revised simplex method. Duality of linear programming. Post-optimal analysis. Transportation problems. Game theory.

Prerequisites:

- MATH103

Textbook(s) and other required material:

- Hamdy A. Taha, (2006) *Operations Research: An Introduction*, 8/E, Perarson.

References:

- Hiller & Lieberman, (2001) *Introduction to Operations Research*, 8th ED., McGraw-Hill.

Major prerequisites by topic:

- Linear algebra.
- Matrix computation.

Course objectives:

- Be able to solve linear programming problems by simplex methods and its variants [a]
- Be able to use duality theory to find solutions to dual pairs of linear programming problems [a]
- Be able to solve transportation problems and matrix game using related methods [a]

Topics covered:

- **Introduction (3 hours):** Give the general idea for optimization. Introduce the linear programming model with examples. Review the graphical method for solving two dimensional problems.
- **Simplex Method (3 hours):** Give some basic concepts and theory of the linear programming problem in equation form. Introduce the simplex method with examples.
- **Artificial Variables Technique (4 hours):** Introduce the artificial variables technique when the problems do not have a starting solution. Study some special cases in the simplex method, including degeneracy, alternative optima, unbounded and infeasible solution.
- **Advanced Linear Programming (5 hours):** Give some simplex method fundamentals, including some basic theory and relations between extreme points and basic solutions. Introduce the generalized simplex tableau in matrix form. Develop the revised simplex method.
- **Duality of linear programming (5 hours):** Give the interpretation of dual variables and constraints. Introduce the matrix definition of the dual problem and study the relations of the optimal of a dual pair. Develop the dual simplex algorithm.
- **Post-optimal analysis (4 hours):** Study the effect to the optimal solution when there are changes affecting feasibility and optimality.
- **Transportation problems (6 hours):** Give the definition of the transportation problems. Study the methods for determining the starting solution and the optimal solution. Give the explanation of the relations between the transportation algorithm and the simplex method.
- **Matrix game (6 hours):** Give the definition of the matrix games and the optimality of two-person zero-sum games. Develop the graphical method. Study the relations between matrix games and linear programming problems. Give the method for solving matrix game by simplex method.

Class/laboratory schedule:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No/Duration of exam papers
Lecture	Tutorial	Practice				
3	2	Nil	14	70	4	1 / 3 hours

Student study effort required:

Class contact:	
Lecture	42 hours
Tutorial	28 hours
Other study effort	
Self-study	40 hours
Homework assignment	15 hours
Total student study effort	125 hours

Student assessment:

Final assessment will be determined on the basis of:

Homework	15%	Attendance	5%
Mid-term	30%	Final exam	50%

Course assessment:

The assessment of course objectives will be determined on the basis of:

- Homework and exams
- Course evaluation

Course outline:

Weeks	Topic	Course work
1	Introduction: Linear Programming Problems Linear programming model; graphical solutions for two dimensional problems	
2	Simplex Method Basic concepts: optimal solution, basic feasible solution; simplex method for problems in feasible canonical form	
3-4	Artificial Variable Technique Techniques for problems in more general forms, the M-method and the two-phase method, special cases in the simplex method: no feasible solution, unbounded solution, alternative optima, degeneracy	Assignment#1
4-5	Advanced Linear Programming Simplex method fundamentals, including some basic theory and relations between extreme points and basic solutions. Generalized simplex tableau in matrix form. Revised simplex method.	Assignment#2
6-7	Duality of Linear Programming Problems Definition of the dual problem, primal-dual relationships, dual simplex method	
7-8	Post-Optimal Analysis Changes affecting feasibility, changes affecting optimality	Assignment#3
9	Revision and Midterm Examination Revision and discussion on assignments	
10-11	Transportation Problems Transportation model and its variants, relation to duality and graph theory, methods for determining initial feasible solutions: North-West corner method, least cost method, etc. The transportation problem algorithm	Assignment#4
12-13	Matrix Game	

Weeks	Topic	Course work
	Model for Matrix game, optimality in game theory, graphical method, relation to linear programming problems and duality, solving matrix games with simplex method	
14	Revision	

Contribution of course to meet the professional component:

This course prepares students to work professionally when dealing with engineering optimization problem in their career.

Relationship to CS program objectives and outcomes:

This course primarily contributes to the Computer Science program outcomes that develop student abilities to:
(a) an ability to apply knowledge of computing, mathematics, science, and engineering.

Relationship to CS program criteria:

Criterion	DS	PF	AL	AR	OS	NC	PL	HC	GV	IS	IM	SP	SE	CN
Scale: 1 (highest) to 4 (lowest)	3													1

Discrete Structures (DS), Programming Fundamentals (PF), Algorithms and Complexity (AL), Architecture and Organization (AR), Operating Systems (OS), Net-Centric Computing (NC), Programming Languages (PL), Human-Computer Interaction (HC), Graphics and Visual Computing (GV), Intelligent Systems (IS), Information Management (IM), Social and Professional Issues (SP), Software Engineering (SE), Computational Science (CN).

Course content distribution:

Percentage content for			
Mathematics	Science and engineering subjects	Complementary electives	Total
60%	20%	20%	100%

Coordinator:

Prof. Zhi Guo Gong

Persons who prepared this description:

Dr. Seak Weng Vong, Prof. Che Man Cheng

Part B – General Course Information and Policies

2nd Semester 2010/2011

Instructor: Dr. Seak Weng Vong
Office: N309
Office hour: Fri 11:30 am – 12:30 pm, or by appointment
Phone: 8397 4359
Email: swvong@umac.mo

Time/Venue: Mon 9:30 am – 11:30 am, J217 (tutorial-class B)
Tue 10:30 am – 12:30 pm, U106 (tutorial-class A)
Thu 9:30 am – 11:30 am, J210 (lectures)
Fri 10:30 am – 11:30 am, J210 (lectures)

Grading distribution:

Percentage Grade	Final Grade	Percentage Grade	Final Grade
100 - 93	A	92 - 88	A–
87 - 83	B+	82 - 78	B
77 - 73	B–	72 - 68	C+
67 - 63	C	62 - 58	C–
57 - 53	D+	52 - 50	D
below 50	F		

Comment:

All students are expected to attend all lectures and examinations. It is your responsibility to read the relevant chapters in the text before and after class and to ask questions during class discussion. In order to be successful in this course, you should get as much practice as possible in solving problems outside the class hours. This must be done on a timely and regular basis, as a good understanding of the material covered in any particular section of this course depends heavily on an equally good understanding of the material covered in previous sections.

Homework policy:

All homework must be an individual effort unless specifically noted. Your work must be neat, with answers clearly noted and supporting information provided. Late homework will not be accepted in general.

Note:

- Cheating in any form will not be tolerated. STUDENTS WHO CHEAT ON ANY ASSIGNMENT, OR DURING ANY QUIZ OR EXAMINATION WILL BE ASSIGNED A FAILING GRADE FOR THE COURSE AND MAY RESULT IN SUSPENSION OR EXPULSION FROM THE UNIVERSITY. Therefore avoid all appearance of improper behavior. Students who witness cheating should report the incident to the instructor as soon as possible.
- Photocopies of the textbooks are illegal and are violation of the Macao copyright laws.
- No make-up exam is given except for CLEAR medical proof.