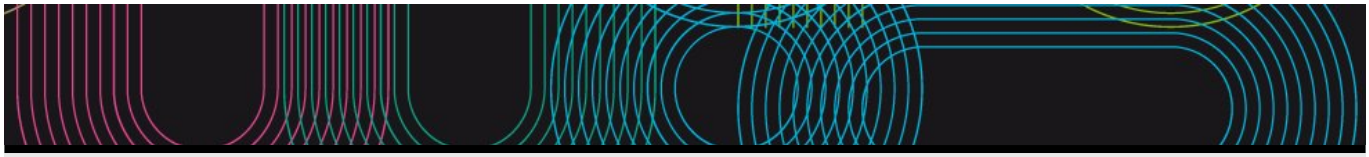

IDENTIFYING DATA				
Networks and planning				
Subject	Networks and planning			
Code	V03M184V01210			
Study programme	M.U. Statistical Techniques			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Bergantiños Cid, Gustavo Lorenzo Picado, Leticia			
Lecturers	Bergantiños Cid, Gustavo Gómez Rúa, María Lorenzo Picado, Leticia			
E-mail	gbergant@uvigo.es leticialorenzo@uvigo.es			
Web	http://eio.usc.es/pub/mte/index.php/es			
General description	In this subject, we present a set of representative models of Operations Research, which involve networks, together with their resolution methods.			

Competencies
Code
A1
A2
A3
A4
A5
B1
B2
B3
B4
B5
C1
C2
C3
C6
C7
D1
D3
D4
D5

Learning outcomes	
Expected results from this subject	Training and Learning Results

Know how to distinguish between the different problems and know which algorithm to use to solve each case.	A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 C1 C2 C3 C6 C7 D1 D3 D4 D5
Know the applications of each problem.	A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 C1 C2 C3 C6 C7 D1 D3 D4 D5
Improve the skills of the student when facing and solving real problems where networks are involved.	A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 C1 C2 C3 C6 C7 D1 D3 D4 D5

Improve the skills of the student in the formulation and resolution of problems with networks.	A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 C1 C2 C3 C6 C7 D1 D3 D4 D5

Contents

Topic	
1. The shortest path problem.	a) Definition and graphic representation. b) Labelling algorithms: Dijkstra and Floyd. c) Applications.
2. The maximum flow problem.	a) Definition and graphic representation. Dual problem: minimum capacity cut. b) Ford-Fulkerson algorithm c) Applications.
3. The transportation model.	a) Definition and graphic representation. b) Methods to obtain an initial basic feasible solution. The transportation simplex method. c) The dual problem. Sensitivity analysis. d) Applications. Particular cases: the transbord problem and assignment problem.
4. The minimum cost spanning tree problem.	a) Description of the problem. Algorithms to compute a minimum costs spanning tree: Prim, Kruskal, Boruvka. b) Allocation rules to divide the cost of the optimal tree between the nodes. Rules based in the algorithms of Prim and Kruskal. Rules based in cooperative games with transferable utility.
5. Project management, the PERT method.	a) Description of the problem. b) The critical path. Calculation of the calendar of the project. c) An example.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	2	10	12
Lecturing	32	31	63
Essay	0	20	20
Objective questions exam	0	30	30

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Problem solving	The students will solve several exercises proposed by the teachers. The students will be able to ask any doubts that may rise over the several lessons of the subject.
Lecturing	The teachers will explain the different concepts of the subject.

Personalized assistance

Methodologies	Description
Problem solving	Students will solve exercises proposed by the teacher. There will be personal online tutorials, where students will be able to expose their doubts to their teachers.

Assessment

	Description	Qualification	Training and Learning Results			
Essay	The evaluation of lessons 4 and 5 will be done by means of the realization of two essays, the resolution of problems and participation in class.	40	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1 C2 C3 C6 C7	D1 D3 D4 D5
Objective questions exam	The evaluation of lessons 1,2 and 3 will be done by means of an exam that will take place in the official date established in the official calendar of exams. Students can use their notes during the exam.	60	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1 C2 C3 C6 C7	D1 D3 D4 D5

Other comments on the Evaluation

Sources of information

Basic Bibliography

Taha H.,, **Investigación de Operaciones**, 9, Pearson, 2012

Complementary Bibliography

Ahuja, R., Magnanti, T.L., Orlin, J.B.,, **Network flows: theory, algorithms and applications**, Prentice-Hall, 1993

Bazahara M., Jarvis J.J., Sherali H.D.,, **Linear Programming and Network Flows**, 4, Wiley, 2002

Ríos Insua S.,, **Investigación Operativa: Programación Lineal y Aplicaciones**, Centro de Estudios Ramón Areces, 1996

Hillier F.S., Lieberman, G.J.,, **Introduction to Operations Research,**, 10, McGraw-Hill, 2015

Larson R., Odoni A, **Urban Operations Research**, Dynamic Ideas, 2007

Martín Martín Q., Santos Martín M.T., De Paz Santana Y.,, **Investigación operativa: problemas y ejercicios resueltos**, Pearson, 2005

Winston W., **Operations research: applications and algorithms**, 4, Thomson, 2004

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
Classes will continue to be taught using the remote campus, keeping all the contents present in the teaching guide. The tutorials will be carried out through email and remote office.

The evaluation system will not suffer any changes, except in the case of the exam, which will be done online through faitic instead of being in person.