UNIVERSIDAD POLITÉCNICA DE MADRID
FACULTAD DE INFORMÁTICA
Campus de Montegancedo
Boadilla del Monte. 28660 Madrid

Rigorous Software Development

Learning Guide – Information for Students

1. Description

Grade	European Master on Software Engineering
Module	Advanced SW Eng. Aspects
Area	
Subject	Rigorous Software Development
Type	Elective
ECTS credits	4
Responsible department	DLSIIS
Major/Section/	

Academic year	2012/13
Term	1st
Language	English
Web site	http://lml.ls.fi.upm.es/rsd/

2. Faculty

NAME and SURNAME	OFFICE	email
Julio Mariño Carballo (Coord.)	2308	jmarino@fi.upm.es

3. Prior knowledge required to take the subject

Passed subjects	
Other required learning outcomes	Basic knowledge of formal logic, and functional or logic programming

4. Learning goals

SUBJECT-SPECIFIC COMPETENCES AND PROFICIENCY LEVEL		
Code	**Competence**	**Level**
SC13	To have a vision of the different specific and emergent aspects of the Software Engineering, and to go further in some of them.	S
SC14	To understand what nowadays software engineering procedures can and cannot reach, their limitations and their possible future evolution.	S

Proficiency level: knowledge (K), comprehension (C), application (A), and analysis and synthesis (S)

SUBJECT LEARNING OUTCOMES			
Code	**Learning outcome**	**Related competences**	**Proficiency level**
LO-ASEA-1	Within an application field of Software Engineering, uses and designs the appropriate solution to solve some of its problems, describing the technical difficulties and the application limits	SC13, SC14	S
LO-ASEA-2	Facing a real problem, chooses an appropriate Software Engineering solution, analyzing its viability, what can and cannot be achieved from the current state of development of the selected solution, and what is expected to advance in the future	SC13, SC14	A
LO-ASEA-3	Explains which are the Software Engineering limits and frontiers, and the base of new tendencies and developments and advanced topics and their possible application	SC13, SC14	P

5. Subject assessment system

ACHIEVEMENT INDICATORS		
Ref	**Indicator**	**Related to LR**
I1	Given a problem, to choose among several formal techniques	LO-ASEA-2
I2	To argue the appropriateness of formal techniques for a given problem	LO-ASEA-1, LO-ASEA-3
I3	Specifying simple procedures	LO-ASEA-2
I4	Proving the correctness of simple code	LO-ASEA-2
I5	Explaining formal specs in natural language	LO-ASEA-2

CONTINUOUS ASSESSMENT			
Brief description of assessable activities	**Time**	**Place**	**Weight in grade**
Individual exercises (if high attendance)	weekly	homework	100,00%
Individual exercises (if low attendance)	weekly	homework	60,00%
Short presentations (if low attendance)	Last sessions	Classroom/ homework	40,00%
			Total: 100%

GRADING CRITERIA

Depending of the number of students, the final grade will be obtained either from:

- a suite of short, individual practical exercises proposed on a weekly basis which will sum up to 60% of the final grade, and then the remaining 40% from short presentations. Exercises belonging to the same unit will be delivered together.
- or just individual practical exercises, if the number of students is too high to allow for the extra sessions needed for the presentations.

Exercises for each unit will have the same relative weight for the overall grade, although individual exercises in a given unit can have different weights.

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6. Contents and learning activities

SPECIFIC CONTENTS		
Unit / Topic / Chapter	**Section**	**Related indicators**
Chapter 1: Introduction	1.1 Overview and challenges for rigorous SW development	I3, I4, I5
	1.2 Review of background: formal logic, declarative programming...	I2
Chapter 2: Specification languages	2.1 Introduction to Z	I1, I3, I4, I5
	2.2 Introduction to Event-B	I1, I3, I4, I5
	2.3 Algebraic specifications	I1, I3, I4, I5
	2.4 Alloy and lightweight methods	I1, I3, I4, I5
Tema 3: Herramientas.	3.1 Herramientas para VDM	I3, I4
	3.2 QuickCheck	I3, I4
	3.3 Alloy Analyzer	I3, I4

7. Brief description of organizational modalities and teaching methods

TEACHING ORGANIZATION		
Scenario	**Organizational Modality**	**Purpose**
	Theory Classes	***Talk to students***
	Seminars/Workshops	***Construct knowledge through student interaction and activity***
	Practical Classes	***Show students what to do***
	Placements	***Round out student training in a professional setting***
	Personal Tutoring	***Give students personalized attention***
	Group Work	***Get students to learn from each other***
	Independent Work	***Develop self-learning ability***

TEACHING METHODS			
	Method	**Purpose**	
	Explanation/Lecture	***Transfer information and activate student cognitive processes***	Known as explanation, this teaching method involves *aim of providing information organized according to c* known as *lecture*, mainly focuses on the verbal expos study. The term *master class* is often used to refer to special occasions

	Case Studies	***Learning by analyzing real or simulated case studies***	Intensive and exhaustive analysis of a real fact, probl interpreting or solving the problem, generating hypoth and, sometimes, training in possible alternative probl
	Exercises and Problem Solving	***Exercise, test and practice prior knowledge***	Situations where students are asked to develop the s applying formulae or running algorithms, applying info results. It is often used to supplement lectures.
	Problem-Based Learning (PBL)	***Develop active learning through problem solving***	Teaching and learning method whose starting point is has to solve to develop a number of previously define
	Project-Oriented Learning (POL)	***Complete a problem-solving project applying acquired skills and knowledge***	Teaching and learning method where have a set time task by planning, designing and completing a series o applying what they have learned and making effective
	Cooperative Learning	***Develop active and meaningful learning through cooperation***	Interactive approach to the organization of classroom their peers' learning as part of a co-responsibility stra This is both one of a number of methods for use and
	Learning Contract	***Develop independent learning***	An agreement between the teacher and student on th independent work proposal, supervised by the teache essential points of a learning contract are that it is a v requiring personal involvement and having a time fra

BRIEF DESCRIPTION OF THE ORGANIZATIONAL MODALITIES AND TEACHING METHODS	
THEORY CLASSES	Explanation/Lecture and Case Studies
PROBLEM-SOLVING CLASSES	Problem-based Learning
PRACTICAL WORK	No
INDIVIDUAL WORK	Problem-based learning
GROUP WORK	No
PERSONAL TUTORING	On demand

8. Teaching resources

TEACHING RESOURCES	
RECOMMENDED READING	Seven Myths of Formal Methods. Anthony Hall. IEEE Software, September 1990.
	Seven More Myths of Formal Methods. Jonathan P. Bowen, Michael G. Hinchey. IEEE Software, July 1995.
	Verified Software: theories, tools, experiments. Vision of a Grand Challenge Project. Tony Hoare and Jay Misra, July 2005.
	First Steps in the Verified Software Grand Challenge. Cliff Jones, Peter O'Hearn, Jim Woodcock. IEEE Computer, April 2006.
	http://wiki.event-b.org/
	The Essence of Z Ed Currie. Pearson, 1999.
	All About Maude -- A High Performance Logical Framework. Clavel, M., Durán, F., Eker, S., Lincoln, P., Martí-Oliet, N., Meseguer, J., Talcott, C. Lecture Notes in Computer Science, vol. 4350.
	Alloy: A Lightweight Object Modelling Notation. Daniel Jackson. ACM Transactions on Software Engineering and Methodology (TOSEM'02), volume 11, issue 2, pages 256-290.
WEB RESOURCES	Subject web site (http://lml.ls.fi.upm.es/rsd)
	Lecture room with blackboard and beamer
	Compilers, tools, etc.

9. Subject schedule

Week	Classroom activities	Lab activities	Individual work	Group work	Assessment activities	Others
Week 1 (6 hours)	Course introduction (2 h.)		• Study (2h) • Individual exercise (2h)			
Week 2 (7 hours)	Ten Commandments of Formal Methods (2 h.)		• Study (3h) • Individual exercise (2h)			
Week 3 (7 hours)	The Z notation. (2h)		• Study (3h) • Individual exercise (2h)			
Week 4 (7 hours)	The Z notation. (2h)		• Study (3h) • Individual exercise (2h)			
Week 5 (7 hours)	Explaining exercises (1h).		• Study (3h) • Individual exercise (2h)		Presentations (1h)	
Week 6 (7 hours)	Event-B (2 h)		• Study (3h) • Individual exercise (2h)			
Week 7 (7 hours)	Event-B (2 h)		• Study (3h) • Individual exercise (2h)			
Week 8	Event-B (2 h)		• Study (3h)			

Week	Classroom activities	Lab activities	Individual work	Group work	Assessment activities	Others
(7 hours)			• Individual exercise / preparing a short presentation(2h)			
Week 9 (7 hours)	Event-B (2 h)		• Study (3 h) *or* preparing a short presentation(3 h) • Individual exercise (2 h)			
Week 10 (7 hours)	Explaining exercises (1 h)		• Study (3 h) *or* preparing a short presentation (3 h) • Individual exercise (2 h)		Presentations (1h)	
Week 11 (7 hours)	Algebraic specifications (2 h)		• Study (3 h) *or* preparing a short presentation (3 h) • Individual exercise (2h)			
Week 12 (7 hours)	Algebraic specifications (2 h)		• Study (3 h) *or* preparing a short presentation (3 h) • Individual exercise (2h)			
Week 13 (7 hours)	Algebraic specifications (2 h)		• Study (3 h) *or* preparing a short presentation (3 h) • Individual exercise (2h)			
Week 14	Alloy (2h)		• Study (3 h) *or* preparing a			

Week	Classroom activities	Lab activities	Individual work	Group work	Assessment activities	Others
(7 hours)			short presentation (3 h) • Individual exercise (2h)			
Week 15 (5 hours)	Exercises and recap (1 h)		• Study (3 h) *or* preparing a short presentation (3 h)		Presentations (1 h)	
Week 16 (5 hours)			• Study (3 h) *or* preparing a short presentation (3 h)		Presentations (2 h)	

Note: Student workload specified for each activity in hours

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