DAT240, DIT596 Model-Driven Engineering, 7.5 hec, VT 2019

Course PM – rev. 2019-01-08

This course PM describes the organization of the course DAT240 (Chalmers) and DIT596 (GU), Model-Driven Engineering, held in spring 2019. The PM is based on the course plans (which are more general, faculty-approved documents following rules at GU and Chalmers). It adds information regarding the organization of teaching, literature coverage, communication, and the course's schedule. Below, text from the course plans appears in blue italics; PM-specific text appears in black and normal text.

Teachers

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Schedule

Blocks: Tuesday 13-16, Wednesday 13-15, Friday 13-17

	Lecture Tue 13:15-14:00	Lecture Wed 13:15-15:00	Group Work 1 (Fri, 13:15-17:00)	Group Work 2 (Tue, 14:00-16:00)
W1	22.1. **13:15-15:00 (full lecture)**	23.1.	-	29.1.
W2	29.1.	30.1.	1.2.	30.1.
W3	5.2.	6.2.	8.2.	12.2.
W4	12.2.	**14.2. Thursday at 15:15-17:00**	15.2.	19.2.
W5	19.2.	20.2.	22.2.	26.2.
W6	26.2.	27.2.	1.3.	5.3.
W7	5.3.	6.3.	8.3.	12.3.
W8			9.3.	

Written exams: **20 Mar 2019 morning** ("FM") in Lindholmen, on **11 Jun 2019 afternoon** ("EM") in Lindholmen, and on **19 Aug 2019 morning** ("FM").

Course Content

Standard visual modeling languages, such as UML, are often not sufficient to fit an organization's needs out of the box. Extending modeling languages with necessary constructs and features, or creating complementary languages, requires specialist knowledge beyond that of software modeling. The purpose of this course is to familiarize the student with contemporary technologies and notations for creating, adapting, and transforming modeling languages, such as domain-specific modeling languages, UML profiles, and languages found in software product lines.

In the 2010 course instance, as in all instances before, we consider MDE technologies provided by the Eclipse Modeling Project (www.eclipse.org) platform. These technologies form the foundations of several commercial modeling tools (e.g., Enterprise Architect, Bridge-point, Rational Software Architect) and are used extensively by modeling practitioners and researchers.

Learning Outcomes

The expected learning outcomes – the knowledge, competencies, and reasinging the examination will test – are as follows:

MDE Learning Outcomes

After completing the course the student should be able to:

Knowledge and understanding

- *explain the following concepts: models, metamodel, platforms, transformation, static semantics, concrete syntax, automated editor generation, model to model transformations;*
- *explain concepts related to contemporary uses and practice of model driven engineering*

Skills and abilities

- *specify metamodels for domain specific languages,*
- *specify syntactic constrains using a constraint language,*
- *realize metamodels within a modeling framework,*
- *realize model editors within a modeling framework,*
- *realize model validators within a modeling framework.*
- *realize model to model and model to platform transformations within a modeling framework*
- *apply model driven engineering technologies to an authentic case.*

Judgment and approach

- *recognize emerging technologies for model driven engineering using relevant information sources,*
- *select appropriate modeling technologies for a modeling tooling problem at hand.*

Literature

In this year, we will primarily use an early release (not-yet published) version of a book co-authored by the course responsible. The full book will be provided at the beginning of the course and might get updates throughout the course.

Main book, available online via Canvas:
[WB17] Andrzej Wasowski, Thorsten Berger, Principles of Software Language Design, 2018

We will also refer to specific chapters of other books, including:
[BCW12] Marco Brambilla, Jordi Cabot, Manuel Wimmer, Model-Driven Software Engineering in Practice, Morgan & Claypool, 2012.

[B13] Lorenzo Bettini, Implementing Domain-Specific Languages with Xtext and Xtend. Packt Publishing Ltd, 2013.

[Gr09] Richard Gronback, Eclipse Modeling Project – a domain-specific language toolkit, Addison- Wesley, 2009.

The texts are complementary. Wasowski and Berger [WB18] describe the whole process of building domain-specific languages in a teaching-book style, including the introduction of important concepts, definitions, and examples. Brambilla et al. [BCW12] describe essential ideas of MDE, introduce essential MDE concepts, and relate this to the technologies used in the course. Bettini [B13] provides a very practical book of two core MDE technologies: Xtext and Xtend, providing a very hands-on description. Gronback [Gr09] explains the specific technologies we will use in the course.

Scientific articles and reference documentations will also be used in relation to the individual lectures and referenced there. However, the development in the tooling for MDE is very rapid and, thus, books get quickly out-of-date. Thus, the students are also required to look at online documentation and other online resources.

Organization

Model of Learning

The course's overall pedagogical strategy is problem-based learning. The learning proceeds by group work, in which an authentic, open-ended problem is addressed. Learning is student directed and student centered, which means that groups are free to address variations of the problems, as long as variants are directed towards reaching the learning goals. The teachers' roles are to facilitate the acquisition of knowledge among participants, rather than to transfer knowledge to the participants.
Several learning resources are provided:

- *Intended Learning outcomes* (above) define what should be learnt and the examination's focus.
- *Problems* "drive" the study activities. To facilitate the right kinds of learning, problems are purposely non-trivial and open-ended.
- The supervisors will give feedback on the solutions to the problems.
- *Literature and lectures* defines and explains all concepts specified by the learning goals.
- *Tools* support practical exploration of the concepts studied.
- *Lectures* (3h every week) set the scope for the studies, and introduce key concepts.

- *Groups* help with knowledge sharing, building collective know-how, collective thinking, division of work, discussions of solutions, pressure, articulation, motivation and many other things.
- *Group supervisor:* each group is appointed a group-supervisor responsible for
    - *helping* groups establishing good group work and problem solving practices,
    - *guiding* groups so that efforts take sensible directions,
    - *monitoring* whether the group is functional, makes progress in the right direction,
    - *giving* feedback on solution,
    - *marking* the groups' weekly hand-ins in collaboration with other supervisors, following criteria set by the examiner. (Final grading is done by the examiner.)
- *Supervised group work* (0,5+0,5h every week) in which
    - the supervisor gives feedback on the hand in of the previous week's assignments
    - the supervisor answers questions with respect to the next assignment.
    - the supervisor offers guidance to solve the assignment, and
    - the group identifies what has to be learnt or done to solve the problem together with the supervisor.

For examination reasons, the Group work is Mandatory and Monitored.

- *Self-directed group work (*7h every week) in which groups work on their own.
- *Feedback on the weekly hand-ins* to confirm the learning of the module's knowledge goals are sufficient or to give feedback that more learning activity is needed on the topic.

Lectures

The role of the lectures is to introduce the participants to the modules' topics and to "kick-start" the learning process; the role is not to cover everything to be learned. Lectures are concentrated, and aim to focus on the big ideas and the most difficult parts. Furthermore, the lectures provide theoretical background, which goes beyond the tool specific level which is required for the problems. Solving the problems, however, usually means going beyond what is covered in the lectures; the exam may ask you to solve problems going beyond what was covered in the lecture (but not beyond the course literature and not beyond the problems).

The Tuesday lectures aim at summarizing the content from the main (Wednesday) lecture of the week before. In addition, the lectures will usually contain quizzes, which are small assignments to be solved during the lecture and marked collaboratively. These quizzes aim at activating students early, in order to understand important concepts, needed for the assignments and the final exam. In fact, being able to solve the quizzes substantially improves the ability to solve the exam, so every student is expected to participate in all lectures, avoiding to miss any quiz.

Problems

Problems, also known as assignments, are distributed using Canvas. Problem descriptions are 1-2 page PDF-files.

Solutions shall be handed in weekly for marking and feedback from group supervisors. The hand-ins as well as the feedback are communicated via Canvas.

> *Hand-ins are compulsory and necessary for passing the course's project examination.*
> *The names of all contributing members (and only these) must appear on each hand-in.*

Problem descriptions contain instructions on what should be handed in. Please follow these instructions carefully, as every minute the group supervisors spend on organizing, selecting, renaming, converting, or looking for files is a minute not spent on giving you feedback.
Deadlines for the hand-in are defined in the individual problem descriptions. The deadlines are hard and will not be extended. Groups or individuals missing the deadline are subject to re-examination.

Groups

- Groups should be 5-6 people.
- Group formation is randomly done by the teachers
- There are no constraints on the groups (beyond the size).
- Group formation takes place between week 1 and 2.

In case of severe conflicts, interpersonal clashes, or communication problems Individuals that leave a group must form another group or fulfill their course on their own (with reduced supervision support). Joining another group during the course is not allowed, as this disturbs group processes, and reduces examination quality.

Supervised Group Work

Supervision is primarily given by the group supervisor. The teachers provide office hours on demand.

Notice: supervision is a limited resource; teachers at universities are not full-time teachers, but researchers doing teaching as part of their job. Furthermore, courses get only a fixed amount of teaching hours. Groups are required to prepare the group supervisions, e.g., identify which questions they want to be answered from the supervisor, what issues they have with their problem solution, what they did not understand from the course.

Opting out from Group Work

Participants are allowed to opt out from *group-work* at the cost of reduced supervision and feedback. Group attachment can be at three levels:

- **Loner.** The participant is not at all associated with a group: the participant solves the problems on his or her own, hands in the solution at whatever times during the course and gets an oral examination at the end of the course's practical part. Private supervision and private written feedback is not provided, but the participant may of course ask questions through PingPons/GUL's discussion forum. (Teachers will answer such questions to a reasonable extent, but not to at the level of private supervision.).
- **Semidetached.** The participant is associated with a group, attends the supervised group work session to get feedback and to join the discussions, but hands in the solution on his or her own. Problems are graded at the end of the course's practical part. Written feedback on hand-ins during the course is not provided.
- **Teammate.** The participant is associated with a group, contributes to the group work, and hands in a solution together with the group. Written feedback on the solution is provided every week, and solutions not passing will be given a second chance during the course. In other words, the resources offered for feedback are supervised group work and feedback on group hand-ins. Private supervision and private feedback on hand-ins is not offered.

Depending on individual learning-style, personality, life-situation or other factors, the participant may or may not take advantage of available resources (but must of course handle his or her choice with responsibility).

Most individuals benefit from group-work; opting out should be done for good reasons. Participants that opt-out from group work should 1) inform the course responsible about the choice and 2) submit their solutions to a special folder for individual hand-ins. Participants who, on repeated occasions (>2) do not attend group work sessions without *valid and convincing reasons* will be excluded from the group (from the point of the first absence) and classified as a loner.

Reading Homework

The main course text is [WB16], complemented by [BCW12], [B13], and [Gr09]. Tool documentations are supplementary. Additional supplementary literature will be published on Canvas.

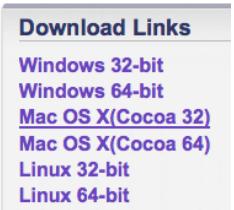
Specifically, the teacher will provide a list of book chapters/sections or papers to read in order to prepare for the next lecture.

Computer and Tools

Course participants must bring their own laptops to the group work sessions.
The distribution to use is Eclipse Modeling Tools, 2018-12:

https://www.eclipse.org/downloads/packages/release/2018-12/r/eclipse-modeling-tools

Important: Download the Modeling Tools edition following the link above, not the standard Eclipse. The software used (Eclipse) is available for the following platforms:



Communication

Course communication is done through Canvas.

Examination

Examination consists of two parts: a written examination (3 hec) and a project examination (4.5 hec). The written examination is individual.
The project examination is based on the outcome of the group work.

Examination of Group Work

- Through the weekly hand-ins (Pass and Fail);
- Through a final report (Pass and Fail).
- Notice that each individual must actively contribute to each and every hand-in to pass the course.
- Individuals who fail to deliver on a module must do the re-examination for the respective parts of the project.
- Only active contributors may put their name on a hand-in. Free-riding will lead to disciplinary action.

Re-examination

Re-examination of the written part is by an ordinary written re-exam. Re-examination of the project part is by:

- submission of missing parts (or re-submission of none non-acceptable parts), and
- by an oral examination (in conjunction with the hand-in).

Grading Logic

Each weekly hand-in is graded with either Pass or Fail. To pass the project part of the course every hand-in must have been passed, and a satisfying project report handed in. Specifically, the project report must be well written and demonstrate knowledge in all teaching modules.
The final grade of the course is determined by the exam grade, given that the project is passed.

Course Evaluation

The course is evaluated through discussion with students, and through the course portal's discussion forums. Immediate changes to the course, as well as changes affecting next year are announced in lectures and through the course portal. Results of course evaluations will be communicated to next year's course participants in the beginning of the course.

The course evaluation follows D&IT's standard process for evaluation of Master Courses.

Study Tactics

Problem-based learning requires somewhat different study tactics than pre-university studies. Although tactics vary with individuals, here is some general advice for this course:

1. **Commit yourself to problem solving**. Problems are designed to "bring out" learning activities necessary for reaching the set learning goals. If you solve the problems, you can hardly avoid reaching the goals.
2. **Keep up with the literature read list**. Each problem is associated with selected chapters to read. These chapters motivate, explain, define, and exemplify the concepts that the problem (and this course) is about. Although lectures introduce the concepts, some reading is typically necessary to resolve questions that arise, and to deepen the knowledge. This said literature is not there to be learnt by heart: study what is relevant to the problem, relevant to the learning goals, or that you just find interesting.
3. **Expect (and learn to deal with) frustration.** Real-world problem solving in authentic contexts comes with hassle (such as tool compatibility problems), surprises (such as seemingly simply sub-problems turning out difficulty), or roadblocks (such as intriguing bugs). In such situations, don't despair. Simplify the problem, get help, discuss the problem with other groups, Google for a solution, do something else for a while, or get some sleep. Then get back to the problem.
4. **Let learning goals guide your study.** Examination is focused on assessing achievement of learning goals, so make sure to understand these goals, and plan your time to achieve them.