Course PM

DAT262 / DIT848, Model-Based Testing, 7.5 Hec, Vt, 2021

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Lecturers: Robert Feldt (main)

Course aim and content:

Testing is one of the most used verification and validation techniques in industry. This course provides the students with a general background on testing techniques, with a focus on the theory and practice of model-based testing (MBT).

The course provides the students with a background on the theory and practice of model-based testing, including how testing tools can be used to improve software quality. General test techniques are explained with focus on model-based testing. Students will get hands-on experience in building models for testing and use these models for both testing and verification purposes.

Learning outcomes:

Knowledge and understanding:
- explain the distinction between software verification and software validation;
- describe the connection between software development phases and kinds of testing;
- describe and explain (a number of) different test methods, and use them in practical situations;
- describe and explain what model-based testing is;
- describe many different types of models and explain their relative merits.

Competence and skills:
- construct models in the modeling and specification languages learned in the course,
- construct appropriate and meaningful tests and explain to stakeholders the results of applying them,
- apply model-based testing on realistic examples using relevant tools.

Judgement and approach:
- understand the trade-offs between and judge which model-based testing approaches and tools best suit a particular situation,
- identify and hypothesize about sources of program failures and reflect on how to better verify the correctness of such programs.

Course structure/course implementation

The course is provided in the form of modules, which combines lectures, discussions and supervised practical work with lab exercises (assignments). Due to the COVID-19 situation the VT 2021 course is given online as a remote/distance course. The students are expected to have prepared for each module and to be active throughout the course. The exercises are both theoretical and practical in nature.

Examination forms:

The course is examined by an individual written exam, carried out in an examination hall, and by multiple, written assignments. Some of the assignments are carried out individually, and some in small groups of normally 2-3 students. Due to the last-minute changes due to COVID-19 we will try to avoid larger group assignments, to simplify the virtual/online student collaboration.

Written examination,   4.5 HEC,   course element 0215
Assignments,   3.0 HEC,   course element 0115

GU, course code DIT848: The grading scale comprises Fail (U), Pass (G) and Pass with Distinction (VG). A Pass grade (G) for the entire course requires at least a Pass grade for all sub-courses. In order to get the grade Pass with Distinction (VG) the student must get the grade VG on all sub-courses.

Chalmers, course code DAT262: The grading scale comprises Not passed (U), 3, 4, and 5.

Written exam (Ordinary): June 2nd 2021 08:30-12:30, home exam, sign up between March 5th 2021 and May 16th 2021.

Written exam (Additional): August 20th 2021 14:00-18:00, home exam, sign up between July 1st 2021 and August 1st 2021.

Regardless if you are a GU- or a Chalmers student, don't forget to sign up for the written examination! This is done in Ladok and can only be done during the sign-up period. Sign-up is mandatory and if you are not you won't be allowed to enter the examination hall.

GU-students, find more information here
Chalmers-students, fins more information here

Course language:

The course will be taught in English.

Course Literature:

Due to the COVID-19 situation the course will rely on papers and online material that is freely accessible. The papers will be made available in Canvas and links will be provided to specific online course material relevant for each course module.
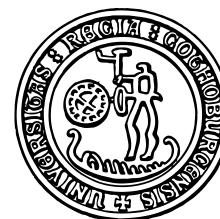
Schedule:

For detailed and up-to-date times and links to online forums where individual events take place please see the course schedule online in Canvas. Videos, links to relevant material, as well as tasks for each module will be uploaded at least 1 day prior to the original, related lecture slot in the schedule in TimeEdit.

Below is an overview but note that due to the online teaching adjustments will be during the course; we refer to the detailed schedule on the course page for the up-to-date information.

Part 0: Introduction and Course Guide
Module 1: Course guide and introduction
Module 2: Overview & motivation - Why testing?
Q&A 1 and Assignment 1 startup: Monday March 29th 13:00-14:30

Part I: Manual and automated testing
Module 3: Testing techniques and White-box testing
Module 4: Coverage-based testing
Q&A 2: Wednesday March 31st 13:00-14:00

Module 5: Black-box testing overview
Module 6: Boundary value testing
Q&A 3: Wednesday April 14th 13:00-14:00

Deadline April 15th 14:00: Assignment 1 final version committed

Module 7: Requirements-, scenario- and risk-driven testing

Part II: Modeling and Model-based Testing
Module 8: Extended Finite State Machines
Q&A 4: Wednesday April 21st 13:00-14:00

Module 9: Graph Theory
Module 10: Model-based testing
Module 11: Simulink
Module 12: UML and Real-world MBT

Q&A 5: Wednesday April 28th 13:00-14:00

Deadline May 7th 14:00: Assignment 2 final report submitted

Part III: Advanced Model-based and Automated Testing
Module 13: Property-based testing
Module 14: Mutation-based testing
Q&A 6: Wednesday May 12th 13:00-14:00
Module 15: Search-based testing
Module 16: Wrap-up and course summary

Q&A 7: Wednesday May 26th 13:00-14:00
Deadline May 28th 14:00: Assignment 3 final report submitted

Written exam (Ordinary): June 2nd 2021 08:30-12:30, home exam, sign up between March 5th 2021 and May 16th 2021.

Written exam (Additional): August 20th 2021 14:00-18:00, home exam, sign up between July 1st 2021 and August 1st 2021.

Additional information:

Changes to the course in recent years:
Since pre 2018, the course has been broadened to cover more different types of models and to also show practical modeling languages and related automated testing approaches used in industrial practice. A single, large assignment has been divided into three smaller assignments and their content changed. One of the assignments uses an open-source model-based testing tool that is also used for testing normal, web, as well as mobile applications. Together this covers a majority of the situations in which present-day model-based and advanced, automated testing is used.

Compared to the 2018 version of the course we have changed one of the assignments to give students more overview of the large number of different testing tools that are available. Based on course evaluations from 2018 we now also randomize groups for assignments.

Due to the COVID-19 situation the 2020 version of the course had to focus more on freely available papers and online courses that complements the lectures. Interaction and discussion was done via online meetings but an increased focus on individual work was necessary due since all teaching in LP4 2020 was done fully remote.

Changes for 2021 was focused on adding more example of testing and coding in pre-recorded videos since these were much appreciated during 2020.

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