CAS 756 Advanced Topics in Formal Methods and Software Architecture

Term 2, 2019-20

Instructor: Prof. Richard Paige
Office: ITB 159A (look for ITB 159, my office is within)
Office Hours: by appointment (typically available on days with lectures)
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Course website: on Avenue to Learn

Notes: midterm recess 17-21 February (no classes)

Course Outline: introduction to modeling, metamodeling and Model-Driven Engineering; constraints; model transformation; model-to-text transformation; model querying; domain-specific languages; concrete vs abstract syntax; EMF; GMF; Epsilon.

Textbooks:

I will not teach directly from a textbook. You may find reading parts of the following book helpful.

- Jordi Cabot, Manuel Wimmer and Marco Brambilla, *Model-Driven Software Development*, second edition.

Lecture notes: made available on the course website hopefully just before each lecture.

Tools: we will be using Eclipse, the Eclipse Modeling Framework (EMF), and Epsilon (http://www.eclipse.org/epsilon). You should download these tools – they're open-source and free – as early as possible in the term.

Prerequisite knowledge and experience:

Basic knowledge of discrete math (particularly basic logic), data structures and algorithms. Familiar with key ideas in software engineering and object-oriented programming. Comfortable with Java programming or in a similar language.

Learning objectives:

You will know and understand:
- The fundamentals of modeling and Model-Driven Engineering.
- The different operations in model management and how they can be implemented.
- The differences between a model and metamodel.
- The definition of a domain-specific language, and the primitives used to build them.

Upon completion of this course, participants should be able to:
- Specify a domain-specific language.
- Implement operations on models, including queries, transformations and constraints.
- Differentiate abstract and concrete syntax.
- Build an editor for a domain-specific language using Eclipse-based modeling tools.

Evaluation:

- A 2.5 hour final examination worth 40%
- A project involving building a domain-specific language, worth 50%. Projects will be presented in the last few weeks of term to the class (schedule to be announced). Your project mark will be based on your submitted deliverables (an editor for your DSL plus a very short report – together worth 75% of your project grade) and your presentation (worth 25% of your project grade).
- Completing four homework assignments, worth 10%

Homework assignments are pass-fail; you will receive 2.5% for submission of a reasonable attempt to complete the assignment. You will receive 0 for not submitting anything.

Collaboration Policy:

You may submit homework assignments either individually or collaboratively, under one of the following two models.

- Collaborate while analyzing the problem and developing an answer or solution, then develop the final solution independently. In this model, each person will turn in a separate document. The submissions must include a section that lists **everybody** you worked with and what each person contributed. You can work with as many classmates as you like with this model, but **only** other students in 756 this term.
- Collaborate from start to finish with at most **two** other students in 756. You must submit one solution and each person will get the same grade. ***The submission must outline what each person contributed.*** Note: Since my experience is that students typically produce better solutions with this type of collaborative solution, I encourage students to follow this model. The incentive is a small (10%) bonus credit per assignment.

MSAF Policy:

- For homework assignments, I will normally offer a short extension to hand-in. If that proves impractical then the value of the assignment will be moved to the final exam.

Important

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.