

Software Verification and Validation: Course overview

Istvan Majzik
majzik@mit.bme.hu

Budapest University of Technology and Economics
Dept. of Measurement and Information Systems

Administrative data

- Lectures in 2019
 - Wednesday: 14:15-16:00, room I.L.405
 - Thursday: 16:15-18:00, room I.L.405
- Official holidays
 - September 12 (BME Sport Day)
 - October 23 (National holiday)
- Web page of the course
 - <https://inf.mit.bme.hu/en/edu/courses/swvv>
 - Uploaded as the course advances:
 - Course material (slides, background materials)
 - News and announcements
 - Homework presentations
 - Exam topics

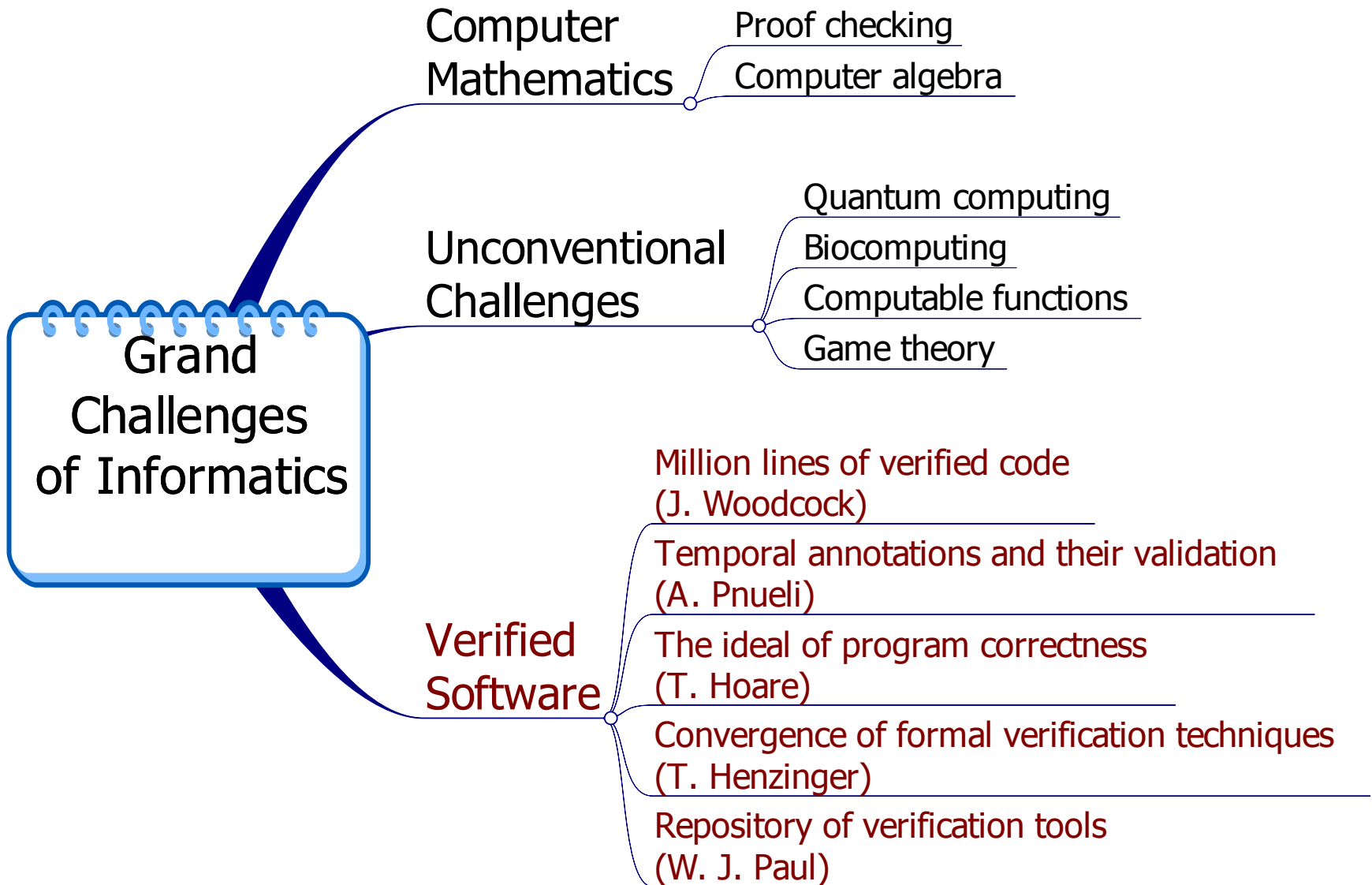
Assessment and requirements

- During the semester: Three options
 1. Oral presentation of a V&V case study based on your own work
 2. Oral presentation of a V&V case study based on selected literature (journal or conference paper presenting a case study)
 3. Submission of a short essay (4-5 pages) that summarizes a case study based on selected literature
- In the examination period: Oral exam based on a list of topics
 - Topics are given in pairs (known in advance)
 - Exam is based on a pair of topics that is drawn randomly
 - In case of having oral presentation (option 1 or 2) during the semester, you are free to select for the exam one topic from the pair
- To do:
 - Negotiate the theme of your oral presentation / essay with the instructor in email <majzik@mit.bme.hu> by October 31, 2019
 - Presentations: in the last 2 weeks of the semester (to be negotiated)

Motivations and goals of the course

- Motivation: Increasing costs of **design faults** in software; this way it is important to ...
 - **verify** that the design and implementation are correct w.r.t. the specification
 - perform verification **in each phase** of the development (not only testing the implementation)
 - **validate** the product or prototype w.r.t. user requirements and expectations
- Goal: **Systematic overview** and **assessment** of verification and validation methods and techniques
 - Classic methods: review, testing, ...
 - Formal methods: mathematically precise techniques based on design models, to prove design correctness

SW verification – Grand Challenges of Informatics



Knowledge to be obtained

- Participants of the course will be able to
 - Understand the **role, advantages and limitations** of various verification and validation (V&V) techniques
 - **Select proper techniques** for each development phase
 - Plan and integrate **V&V processes** that support development processes
 - Understand the **mathematical background** of emerging techniques (e.g., formal verification, static source code analysis, model based test case generation)
 - Know **typical tools** that support V&V techniques
- Background included from previous courses:
 - Software and System Verification (testing techniques)
 - Formal Methods (temporal logic, model checking)

Synopsis

- Introduction
- Verification in the **requirement specification phase**
- **Architecture** verification and evaluation
- Verification of the **detailed design**
 - Classic techniques
 - Formal methods: model checking, equivalence checking
 - Advanced methods: formal verification of extra-functional properties and timed behavior, handling complex designs (large state spaces)
- Verification of the **source code**
 - Code review, abstract interpretation, symbolic execution
 - Classic techniques of proving program correctness
- Testing and **test design**
 - Test case generation at unit level
 - Integration and system testing
 - Model based testing and test case generation
- **Validation** and assessment
- V&V in the **maintenance** phases
- Integrated approaches (esp. formal frameworks)

Proposal: Lectures “on demand”

■ Motivations

- Slides are detailed, these may be suitable for individual processing and understanding
- Several topics may have been covered by previous studies
- Some parts of the material are based on previous courses (repeated here in order to have a common basis)

■ “On demand” approach

- Each lecture has a well-defined topic
 - Related slides will be available in advance at the web site of the course
- Students attending a given lecture will decide whether they ask the presentation of the complete topic, or only the presentation / explanation of selected parts
 - Selecting only those parts that are not clear or seem to be difficult
 - Presentation of the complete topic is the default
- Prerequisite: looking at the slides before the lecture