AIMS Embedded Systems Programming
MT 2018
Introduction

Daniel Kroening

University of Oxford, Computer Science Department

Version 1.02, 2018
Outline

Motivation

Overview of the Week

Reading

How?
Motivation

Software *most complex component* of critical systems
Overview of the Week

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Basics of C</td>
<td>C++</td>
<td>Unified Modeling Language (UML)</td>
<td>Labview (Alessandro Abate)</td>
</tr>
<tr>
<td>Micro-architectures</td>
<td></td>
<td>IEEE floating point Tooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assembler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D. Kroening: AIMS Embedded Systems Programming MT 2018
Monday

- Introduction

- Micro-architectures
  - CPUs, busses, memory, caches

- Assembler
  - x86 vs. MIPS, ARM
Basics of C
- language
- bit-vector semantics
- functions
- pointers, structs, data structures
- compilation units and modularisation
- memory-mapped I/O, interrupts, threads
Wednesday

- C++
  - classes and objects
  - inheritance
  - exceptions and resources
  - templates

- IEEE floating point
  - representation of numbers and rounding
  - compiler support in C
  - common mistakes and problems
  - basic numerical recipes

- Tooling
  - git, subversion
  - unit testing, regression testing
  - coverage metrics and safety standards, MISRA-C
Thursday

- Unified Modeling Language (UML)
  - design spiral
  - behavioural diagrams
  - class diagrams
Labview
Done by Alessandro Abate and a NI guy
Not in LR7, but in the lab.
What?

Prerequisites

- Basic imperative programming
- Basics of computing hardware

Learning Outcomes

At the end of the course students will:

- Be able to undertake basic programming assignments
- Self-instruct further techniques and details, as needed
There is more. I am not covering

- Tools for project management
- Requirements
- DSPs and other highly deterministic CPUs
- SoCs
- Power management
- GPUs or vector units
- FPGAs
- . . .

No background assumed on any of these either.
Reading

*The C++ Programming Language*
Bjarne Stroustrup

*Programming for Engineers: A Foundational Approach to Learning C and Matlab*
Aaron R. Bradley
Schedule

Lectures: MT week 6 Mo–Fr 10–12, LR7

Labs: MT week 6 Mo–Fr 14–16
Run by John Galea
DPhil in CS (Cybersecurity CDT)
He has emailed you!
Assessment

- Assessment is by report
- Due Monday week 6
- Primarily cover what you have done, i.e., your labs, and the lab sheets
- You can skip the trivial stuff
- You can skip Friday’s stuff