System-Level Programming

2 Organization of the Lecture

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Lehrstuhl für Informatik 4
Systemsoftware

Friedrich-Alexander-Universität
Erlangen-Nürnberg

Summer Term 2024

http://sys.cs.fau.de/lehre/ss24

Lecture

- Content and topics
  - Basic concepts of system-level programming
  - Introduction to the programming language C
    - differences compared to Python/Java
    - modular concept
    - pointers and pointer arithmetic
  - **“Bare-metal”** software development directly on hardware (ATmega μC)
    - mapping of storage $\leftrightarrow$ language constructs
    - **interrupts** & **concurrency**
  - Software development on **operating system** (Linux)
    - operating system as a runtime environment for programs
    - abstractions and services of an operating system

Lecture

- 36 sections
  - slides on the web server `syc.cs.fau.de`
  - dates: see **semester overview**
  - → requirement for successful handling of the exercises
- Questions on the lecture
  - ideally ask **immediately**
  - in following lecture
- Q&A at the end of the term
- **Lecture does not replace the tutorials and hands-on exercises!**

Exercises

- Tutorial and hands-on exercise
  - Tutorial (Tafelübung)
    - distribution of and additional information for the programming assignments
    - joined development of an outline for the solution
    - discussion of the solution the week after

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  - Hands-on exercise (Rechnerübung)
    - independent programming
    - working with development tools
    - support from an exercise supervisor
- Appointments: choice of 8 + 1 groups
  - registration via Waffel from Thursday 04/18/2024, 6pm (refer to website)
  - **seperate** group only for for SLP

Valid login for the Linux-CIP required for participation in exercises!

Exercises

WARNING!

There will be **no tutorials & exercises** during the winter term for students who failed the exam

WARNING!

Programming Assignments

- Practically apply lecture contents
  - **eight programming assignments** ↪ 2–11
  - including assignments in groups
- Solutions must be submitted in the SPiC-IDE
  - your solution is validated with the help of scripts
  - we correct the assignments give points and provide feedback
  - a solution will be presented by a student in one of the following tutorials **requires attendance!**

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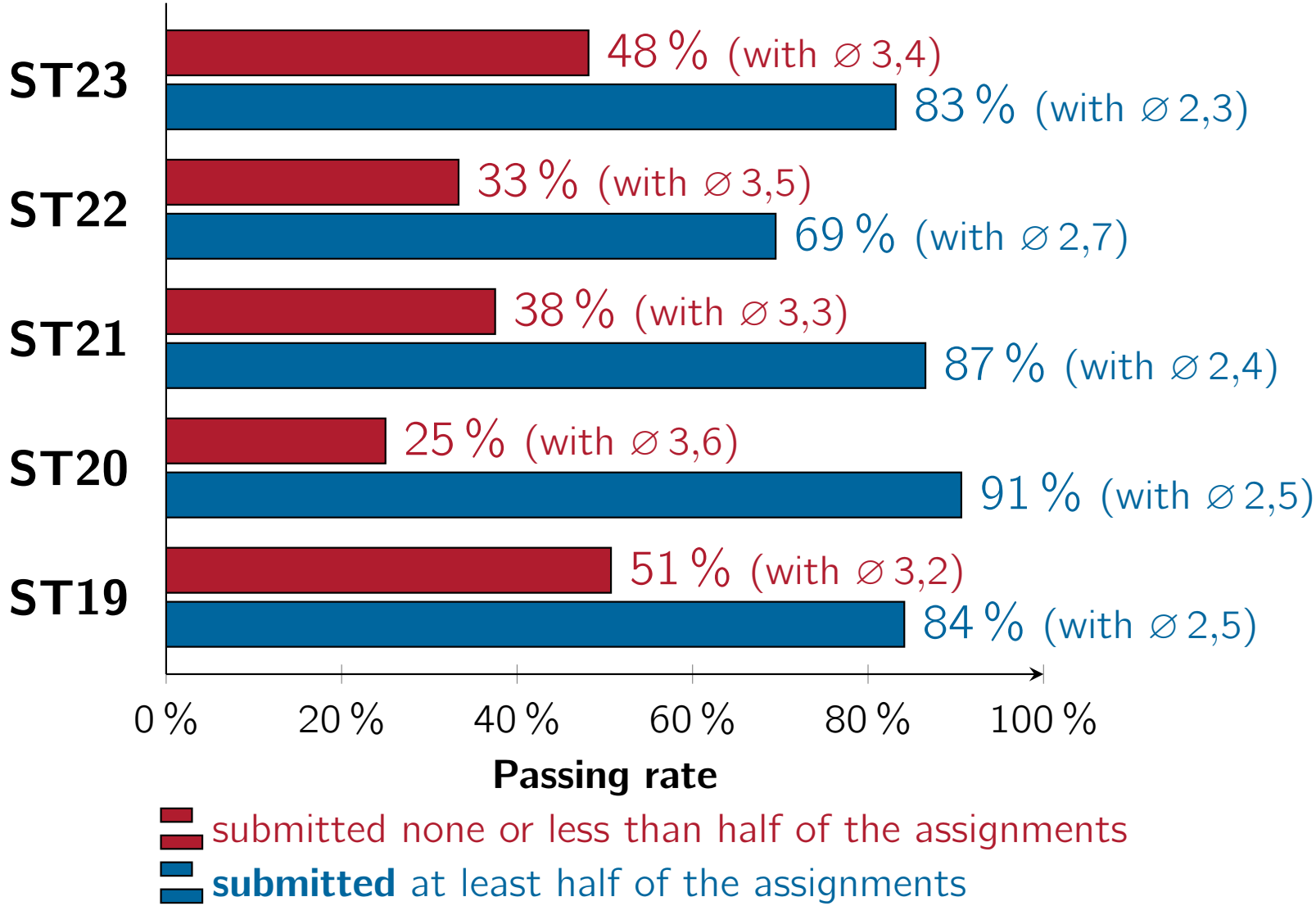
Nonetheless, the participation in the assignments is **highly recommended!**

Passing Rate of the Exam (SPiC)

By activity of the participants in the programming assignments.

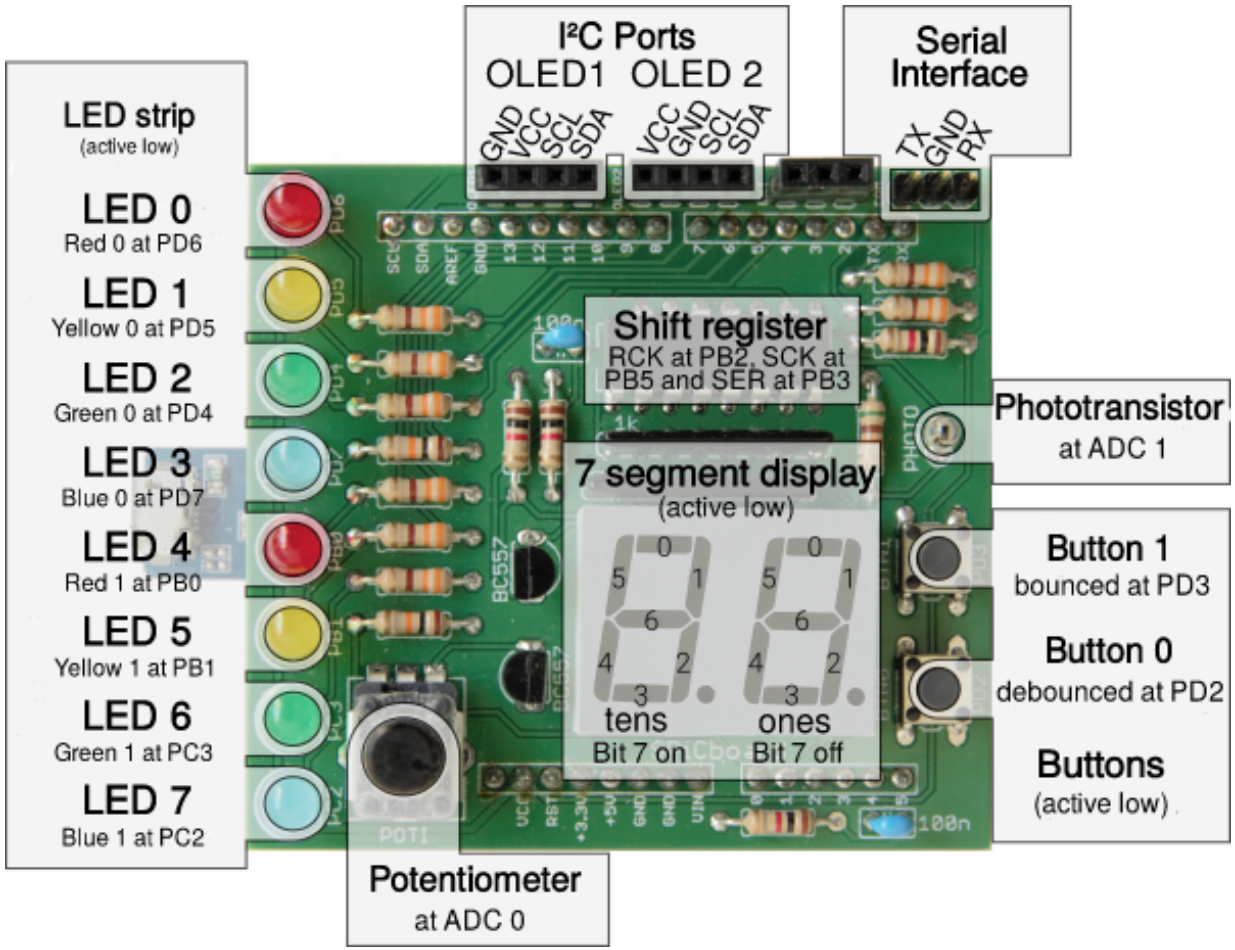


Exercise Platform: the SPiCboard

- ATmega328-μC
- USB port
- 8 LEDs
- 2 7-segment elements
- 2 buttons
- 1 potentiometer
- 1 photo sensor

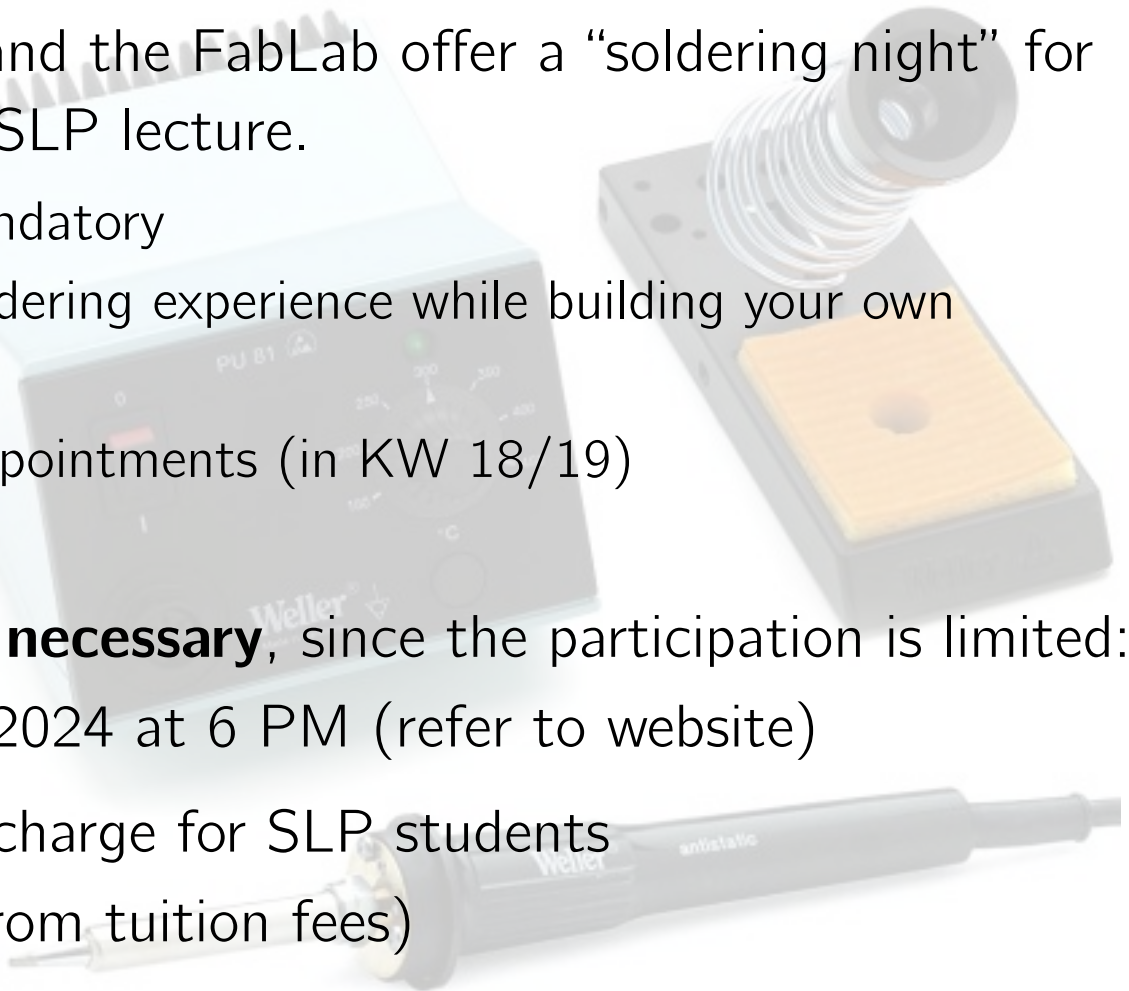
optional:

- OLED display



- can be borrowed during hands-on exercises
- better option: ↪ solder one by yourself!
- alternatively: development in simulator, which is integrated into the IDE

SPiCboard-Soldering Night



- The FSI EEI, FSI ME and the FabLab offer a “soldering night” for the participants of the SLP lecture.
  - participation is not mandatory
  - you can gain (first) soldering experience while building your own SPiCboard
  - there will be likely 4 appointments (in KW 18/19)
- Registration via Waffel **necessary**, since the participation is limited: from Thursday 04/18/2024 at 6 PM (refer to website)
- Participation is free of charge for SLP students (materials are funded from tuition fees)

The date you choose to register is binding!

Exam and Final Grade

- Exam (written test)
  - date: expected in early august
  - length: 90 min (SLP)
  - contents: questions on the lecture + programming exercise
- Exam grade $\mapsto$ final grade
  - (Usually) 50% of the exam's maximum possible points (EP) are necessary to pass.
  - Only if you passed, your grade can be improved by your bonus points from the programming exercises.
    - minimum: 20% of possible bonus points (BP)
    - bonus points get divided in equal parts to match the interval [50%;80%] of possible BP

    $\rightsquigarrow$ having 80%-100% of possible BP $\mapsto$ +10% of the maximum EP

Semester overview

CW	Mo	Tu	We	Th	Fr	Themen
16	15.04.	16.04.	17.04.	18.04. LEC1	19.04. LEC2	Introduction, Organisation of the Lecture, Java/Python vs. C – Some Examples Software Layers and Abstraction, Language Overview, Basic Data Types
17	22.04. E1	23.04.	24.04.	25.04. LEC3	26.04.	Operations and Expressions, Control Structures, Functions, Variables E1 (blink)
18	29.04. E2	30.04.	01.05. Tag der Arbeit	02.05. LEC4	03.05.	Preprocessor, Program Structure and Modules, Pointers and Arrays E2 (snake)
19	06.05. E3	07.05.	08.05.	09.05. Christi Himmelfahrt	10.05.	E3 (led-modul)
20	13.05.	14.05.	15.05.	16.05. LEC5	17.05.	Pointers and Arrays, Composite Data Types, µC-System Architecture – Preface, µC-System Architecture – Processor, µC-System Architecture – Periphery
21	20.05. Pfingstmontag E4	21.05. Bergdienstag	22.05.	23.05. LEC6	24.05.	Interrupts, Interrupts – Example, Interrupts – Concurrency E4 (spiel)
22	27.05.	28.05.	29.05.	30.05. Fronleichnam	31.05. No Lectures	
23	03.06. E5	04.06.	05.06.	06.06. LEC7	07.06.	Dynamic Allocation of Memory, Organisation of Memory, Organisation of Memory – Stack, Organisation of Memory – Summary E5 (ampel)
24	10.06.	11.06.	12.06.	13.06. LEC8	14.06.	Additions: Pointers, Additions – In-/Output, Additions – Error Handling, Operating Systems
25	17.06. E6	18.06.	19.06.	20.06. LEC9	21.06.	File Systems – Introduction, File Systems – UNIX E6 (concat)
26	24.06. E7	25.06.	26.06.	27.06. LEC10	28.06.	Programs and Processes, Programs and Processes – UNIX, Signals E7 (printdir)
27	01.07. E8	02.07.	03.07.	04.07. LEC11	05.07.	Multi Processors, Concurrent Threads, Concurrent Threads – praxis E8 (mish)
28	08.07.	09.07.	10.07.	11.07. LEC12	12.07.	Exam Preparation
29	15.07.	16.07.	17.07.	18.07. Q&A	19.07.	Question & Answer

Details: http://sys.cs.fau.de/lehre/ss24

Contributing Individuals, LS Informatik 4

Lecturer

Volkmar Sieh

Jürgen Kleinöder

Peter Wägemann

Organization of the tutorial and exercises

Maximilian Ott

Contributing Individuals, LS Informatik 4 (continued)

Tutorial mentors

Jannik
Hausladen

If there are Questions or Problems

- Take a look at the lecture or tutorial slides
- Consult the FAQ on our website
- Hands-on exercise
- Only if you still have no answer or in special cases, write an email to
  → all tutorial advisors i4spic@lists.cs.fau.de (content-related)
  → all academic staff (of this lecture) i4spic-orga@lists.cs.fau.de (organisational questions)