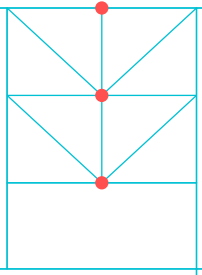
Course Introduction

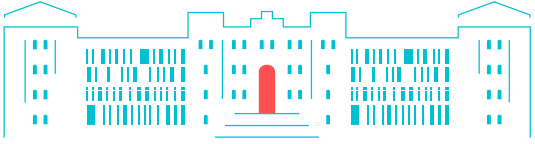
Programmierparadigmen – Objektorientierte Programmierung (OOP)

Week 1/14 – version 26.0

TUHH
Hamburg
University of
Technology

Institute for Autonomous Cyber-Physical Systems





Thibaut Lunet

What is this course ?

Module for second semester bachelor students

- Mandatory for CS, DS, IIW, TM / Vertiefung for AI, ES
- Available for any voluntary ...

Main goals

Continuation of "Prozedurale Programmierung für Informatiker" (C programming)

- C++ (∼2/3 of the content) and Python (∼1/3 of the content)
- learning **Object-Oriented Programming** (and a bit about other Programming Paradigms)
- consolidation with Git, compilation and debug of programs, project development, ...

Note :

lectures will be (mostly) in English, but you can also communicate with me in German or French ...

How is it going to work ?

General organization

- 1 lecture (Vorlesung – VL) + 1 tutorial (Hörsaalübung - HÜ) every week
- 1 exercise session (Praktikum – PR) every weeks starting next week, with *bonus points*
- one programming project, starts after the mid-semester holidays
- exam at the end of this semester, *second chance exam end of next winter semester*
  → see webpage for exam dates ...

Official StudIP Course → *you **have to register** for notifications + blubber*

Gitlab Repository (Repo) for **up-to-date material and infos**
→ *access with your StudIP login (**LoginID**, e.g* cpf5546*) and password*

Organisation – Lectures

Lectures

Vorlesung : **Thursday 8:00** → **9:30** in Audimax I (except 23.04.2026 in Audimax II)
Hörsaalübung : **Friday 8:45** → **9:30** in Audimax II

- slides and example codes uploaded on Gitlab
- mostly in English, with a touch of German
- possible zoom link (with good reason) but **no recording**
- exceptional session in zoom only (**if any**, will be specified in advance)
- some weeks won't have lecture (cf. StudIP and TUNE)
- small (free) knowledge test during Hörsaalübung (MCQ) on content from previous lecture

*Slides are on Gitlab (some will be reworked during the semester, **check the version !**)*
→ replace `blob` by `raw` in slide's url to get a **pdf view**

Organisation – Exercises

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Exercise Sessions

All on Friday : 11 groups **9:45** → **11:15**, 1 group **13:15** → **14:45**

→ ∼ 18 students per groups

- **work in teams** (3 or 4 students), using a shared Gitlab repository (more details later ...)
- instructions in English, support by your tutor (German, English)
- bonus points for the exams (more details later ...) :
  1. **Problem solutions** : solve a few issues with small code snippets (checked by tutors → 2 pts)
  2. **Programming tasks** : implement a program for a given task (automatically checked → 2 pts)
- timeline :
  1. April 10th : Team registration & Support-at-start (tutors will be in their room, see Gitlab)
  2. April 17th : first session (S01)
- **personal laptop needed** (if not possible, come see me at the end ...)

Organisation – Exercise Groups and Teams

Groups and team distribution – see rules on Gitlab ...

- formed during the first week (deadline on the HÜ before the first session)
- required for exercise and project evaluation
- possible adaptations in function of constrains

1 – Form your team (3–4 people) by talking to others

2 – Check which groups are still open on Gitlab and choose one

3 – Communicate all your StudIP LoginIDs and your team name to the group's tutor

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Note : alone or only two, don't know anyone to form a team ? Use the **StudIP blubber**

1. quickly present yourself, motivations, current level
2. contact other people who also used the blubber

Full instructions on Gitlab

Tutors presentation

Quick round

- which semester and field of study ?
- spoken languages and tutor experience ?
- programming languages and operating system affinity ?
- what did you dislike the most when attending OOP as a student ?

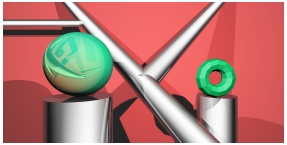
Organisation – Project

Programming Project

Implement a program for 3D visualization using "raytracing"

- combines a bit of math, optical physics and practical use of OOP
- collaborative project within exercise teams, official start after semester holidays
- additional bonus points for the exam

Some examples from last year's projects ...




Full project instructions

Exam and Grading

TUHH

Main written exam – 6 ECTS (Leistungspunkte)

- 90 min. duration, 40 exam points in total :
  → 20 points to pass (4.0 grade), 38 points for best grade (1.0 grade)
- questions in English, answers in English or German, **no tools neither aids**
- first date after Summer Semester, second after Winter Semester

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- 10% from mean of exercises evaluations (max. 4 exam points)
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→ *getting all bonus points get your grade from 4.0 to 2.7 (for instance)*

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Already did the exercises last semester and collected bonus points ? ...

- highly recommended to do them again (different problems and tasks, practice opportunity)
- bonus points are kept over semesters, only best semester is used

More details and **reference solutions** for the last exams on Gitlab

Course content

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First part : Object Oriented Programming (OOP) in C++ (5 weeks)

- *Introduction to C++ and basic OOP (scopes, shadowing, overloading)* – 3 weeks
- *Advanced OOP : Inheritance and Polymorphism* – 2 weeks

Second part : Advanced C++ concepts (3 weeks)

- *Memory Management / Error Handling / Move Semantic & Template*

Third part : Python & Applications (6 weeks)

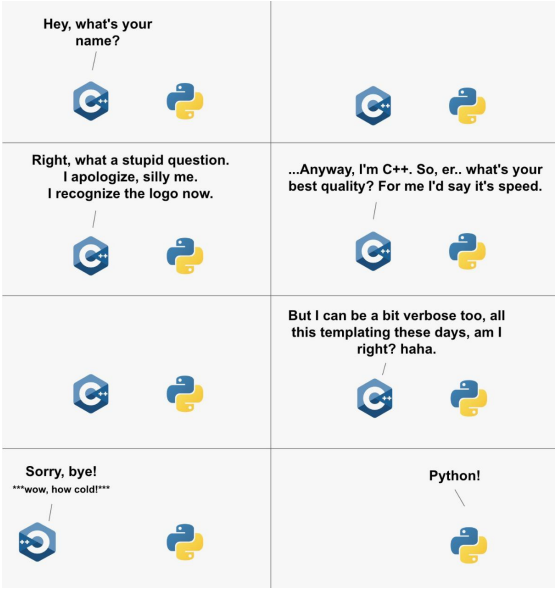
- *From C++ to Python, OOP in Python, other fancy stuff in C++ & Python*

In parallel : data versioning and collaboration with Git, code development with VSCode

Full detailed timeline on Gitlab, as usual ...

Some explanations ...

Why learning C++ and then Python ?



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1) Both are Object Oriented, but :

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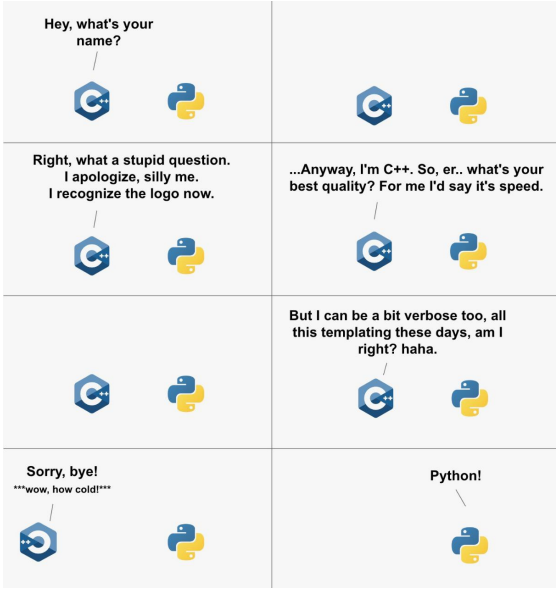

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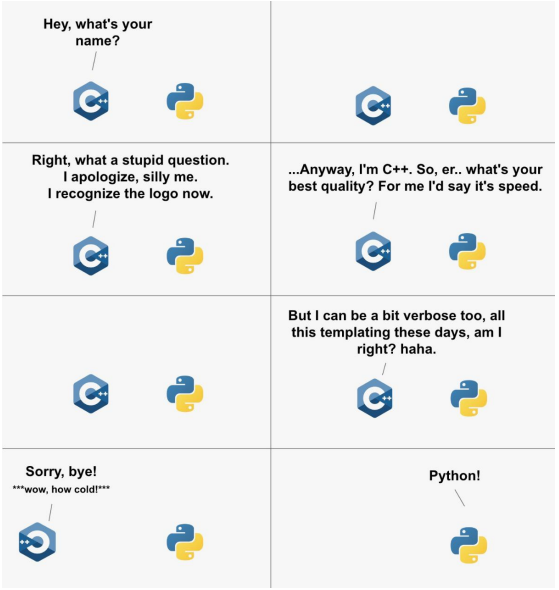
→ data science, scientific computing, web, ...



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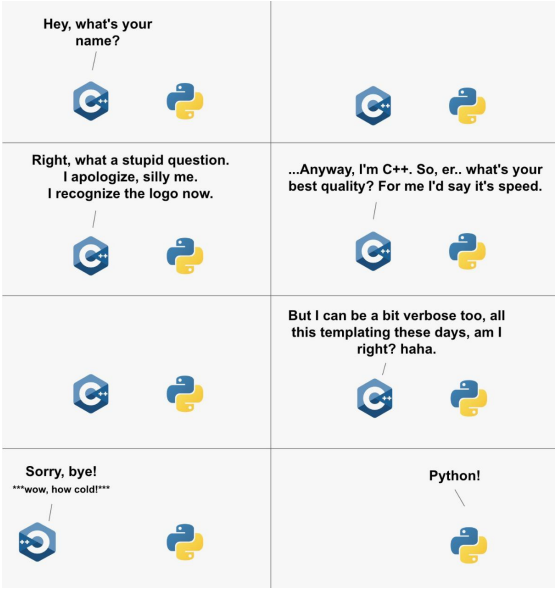
"Hard Training, Easy War"

Proverb of the French Foreign Legion



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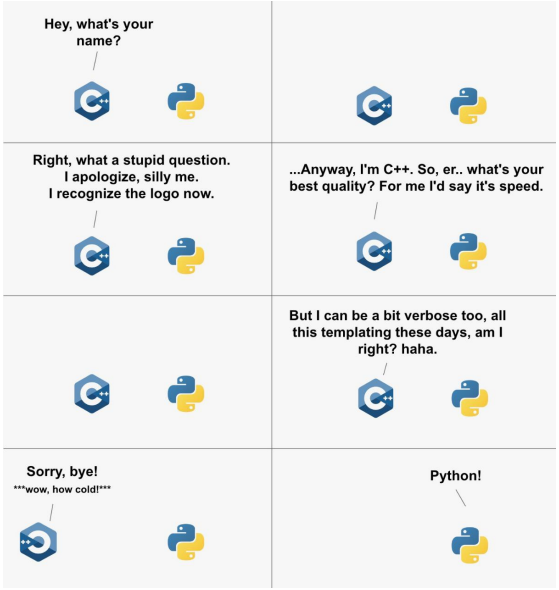
4) Competences in C, C++ and Python
⇒ ground basis for any other progr. languages



Support and communication during the semester

A) Everything is on Gitlab !

- access to up-to-date information and materials (slides, codes, exercises, previous exams, ...)
- keeping track of the main changes with the news page
- forum for questions and problems with Gitlab Issue (demonstration ...)
- ... but you still **have to register on StudIP** to receive group emails and notifications !

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B) Move yourself too !

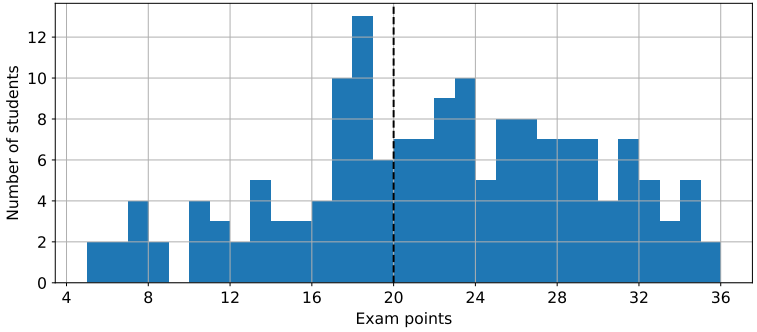
- do not hesitate to contact your tutors → list on Gitlab
- you can write me at thibaut.lunet@tuhh.de – **please don't use the messaging system of StudIP !**

Important detail : I'm still young and motivated ...

- you can drop by **any time** in my office CH4 1.021 (ACPS Institute) ...
- *... but to be sure that I'll be there and available, just* ***send me an email before !***

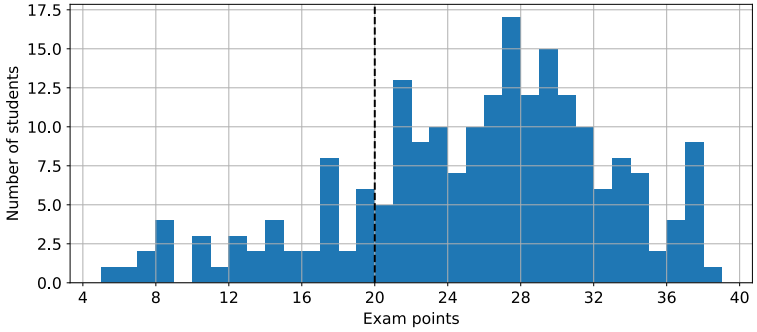
Time to wake up for the important warnings !

Grade distribution from SoSe23 exam : 164 corrected exams, 38.4% fail rate



Time to wake up for the important warnings !

Grade distribution from SoSe24 exam : 210 corrected exams, 19.5% fail rate



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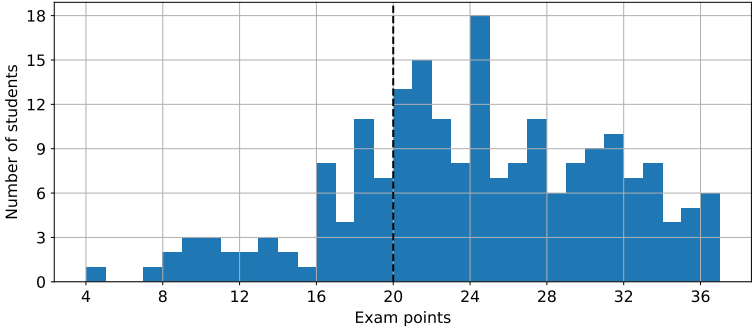
Grade distribution from SoSe25 exam : 204 corrected exams, 24.5% fail rate



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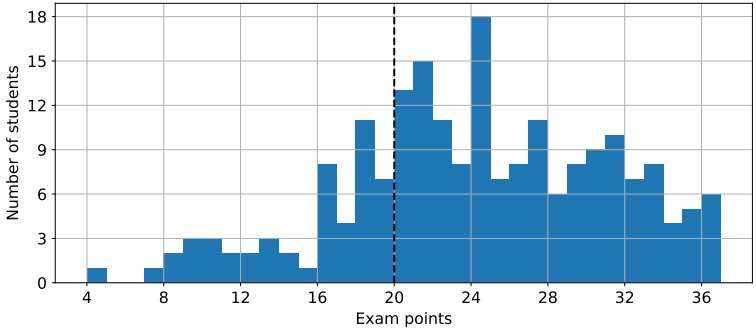
Grade distribution from SoSe25 exam : 204 corrected exams, 24.5% fail rate



- **don't wait** for the last weeks before the exams to work !
- 6 ECTS ⇒ you are supposed to work ∼**9 hours** per week (in addition to VL, HÜ and PR ...)
- **regularly doing the exercises helps a lot**, see statistics ...

Note : tutorial on *"how to prepare for the exam"* at the end of the semester

For those who struggle ...

A bit of advices :

1. *never give up !*

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Checkout the "success stories" to get inspiration ...

Use of Generative AI (ChatGPT & friends)

Allowed, and even recommended in some cases ... **BUT**

1. **do not use it** as auto-completion tool (*e.g* GitHub Copilot) ... yet !

   → *first improve your coding skills (for 1 or 2 years), then* ***use AI as a skill multiplier***

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PS : even I can make some mistakes in the lecture content ... even intentionally !

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Usage recommendations

- generate questions / problems on a topic, and check your answers
- try different AI to compare their answers (like Le Chat, DeepSeek, Claude, ...)

... and always work on your capacity to synthesize !

Some final quotes ...

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"Understanding is what makes you better than machine learning"

"There are no stupid questions ...
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Bref : *I'm willing to give you as much as I can, but I won't chase you for that ...*
→ ***you'll have to do the first step !***