Introduction to Computer Science for Geographers

Introduction

Christina Ludwig

Seminar im Sommersemester 2019

Arbeitsgruppe Geoinformatik,
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UNIVERSITÄT
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ZUKUNFT
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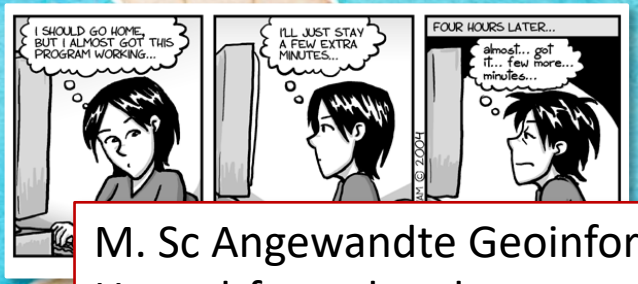
About me



M. Sc Angewandte Geoinformatik
Umweltfernerkundung

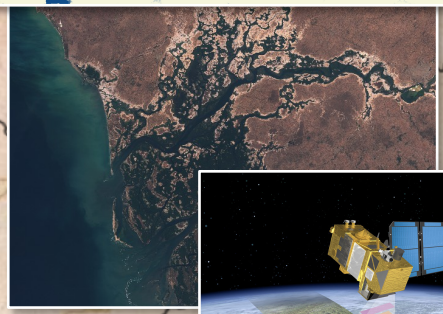
Trier

Heidelberg

Augsburg

Freiburg

Innsbruck



B.Sc Umweltnaturwissenschaften
NF: Meteorologie / Klimatologie

GeoVille Information Systems
MA + Junior RS Expert

Contact details

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Question 1

Which software tools have you used before to perform GIS analyses?

Question 2

Which problems did you face during these projects?

Question 3

What would you like to learn to avoid those problems in the future?

Time table

BYOE: **B**ring **Y**our **O**wn **E**rrors

Time	Day 1	Day 2	Day 3	Day 4	Day 5
9:15 – 9:45	**Introduction**	Questions	Questions	Questions	Questions
9:45 - 10:45		Computer Hardware	Program Design	Errors, Debugging, Testing	APIs
10:45 - 11:00	BREAK	BREAK	BREAK	BREAK	BREAK
11:00 - 12:30	Programming Languages	Numpy	Program Design	Errors, Debugging, Testing	Open Space
12:30 - 13:45	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
13:45 - 15:15	Vector data in Python	Raster data in Python	Documentation and code style	Profiling & Efficiency	Final Assignment
15:15- 15:30	BREAK	BREAK	BREAK	BREAK	BREAK
15:30 - 16:15	git session	git session	git collaboration	Profiling & Efficiency	
16:15 - 16:30	Questions + Feedback	Questions + Feedback	Questions + Feedback	Questions + Feedback	

Learning objectives of this course

By the end of the course you will be able to …

- … describe the components of a computer and how they affect your program.
- … write a well structured, readable and documented program.
- … keep track of all your changes during the development process.
- … test your program to ensure correct and reproducible results.
- ... analyze the program for computational efficiency.
- ... adapt the program so that it can process large geo data sets in pieces.

→ Final goal: Have more control and trust in your programs and results.

Agenda

1. Administrative information
2. How does this course work?
3. Computer Science and Geographers?
4. **Hands-on:** git

Learning goals

1. Describe the differences between a computer scientist, a geographer and a geoinformation scientist.
2. Explain the concept of git and why it is relevant for a scientist and yourself.
3. Clone a git repository.

Creditability

- Bachelor
  - Methoden in der Geographie III (MG 3): Geographische Informationssysteme: Blockseminar
    4 ECTS
- Master
  - Geographische Arbeitsmethoden (GM) – Übung
    5 ECTS
  - Forschung Geoinformatik 1 (FG01) - Übung
    5 ECTS
- Prerequisities are Cartography and Introductory GIS

Examination mode

- Attendance during the whole block course is mandatory.
- Grade depends on …
  - participation during block course [20%]
  - final assignment [80%]
- Final assignment:
  - Practical programming project in Python
  - Sumission deadline is 1st of October 2019
- Deregistration possible until Friday, August 9th

Agenda

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How does this course work?

YOU are responsible for your learning progress!

- Ask questions!
- Work together!
- Help each other!

What do you need for a good learning environment from your peers, the instructor and the course itself?
→ https://answergarden.ch/970708

Important note

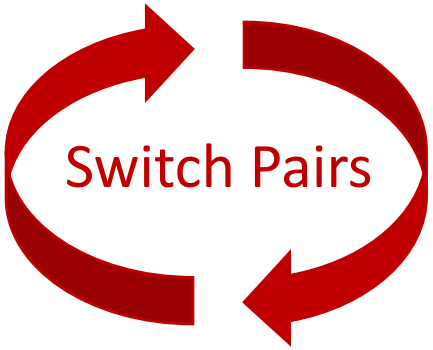
No one is born a programmer

„[…] competence at programming is not innate but is rather a learned skill that can be acquired and improved with practice“ (Brown and Wilson, 2018)

So don’t panic if you don’t understand everything right away and don’t mock others for not knowing stuff.

Pair Programming

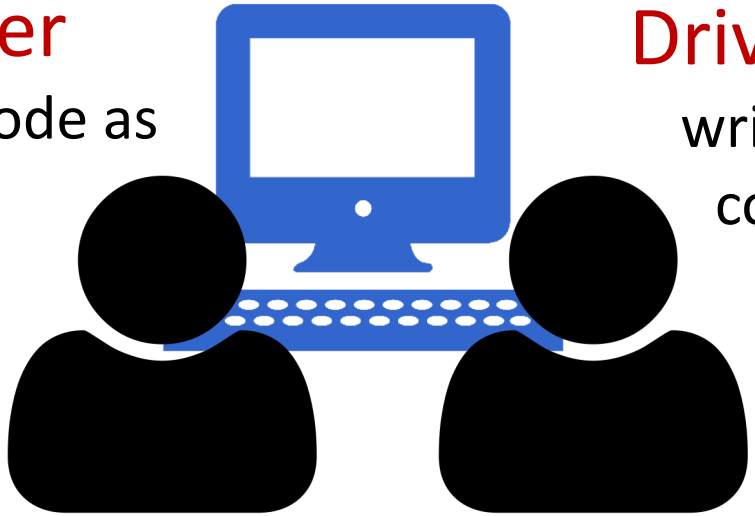
- Agile Software Development method, but great for courses too
- Switch pairs after sessions



Switch after every exercise

Observer
reviews code as it is typed

Driver
writes code



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Question

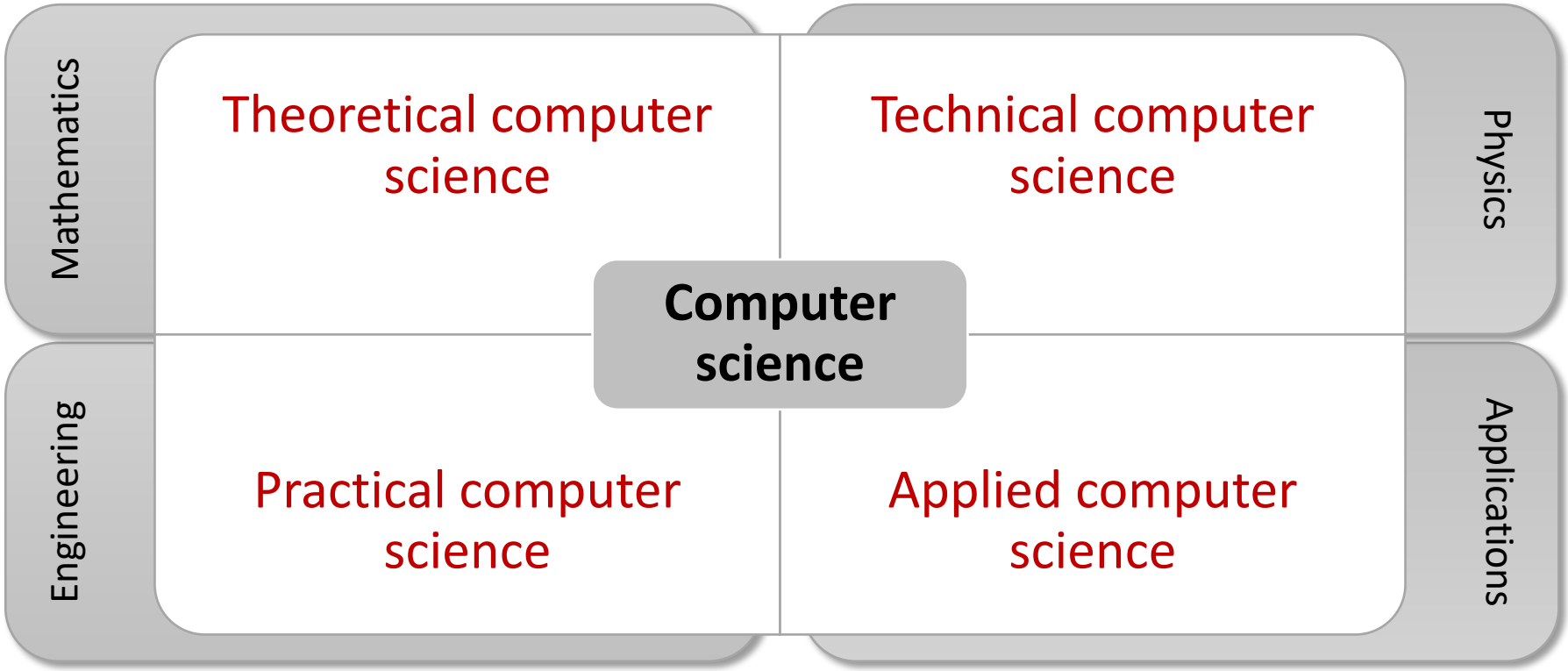
Where would you put yourself on this spectrum?

Computer Scientist ”GeoinformatikerIn” Geographer

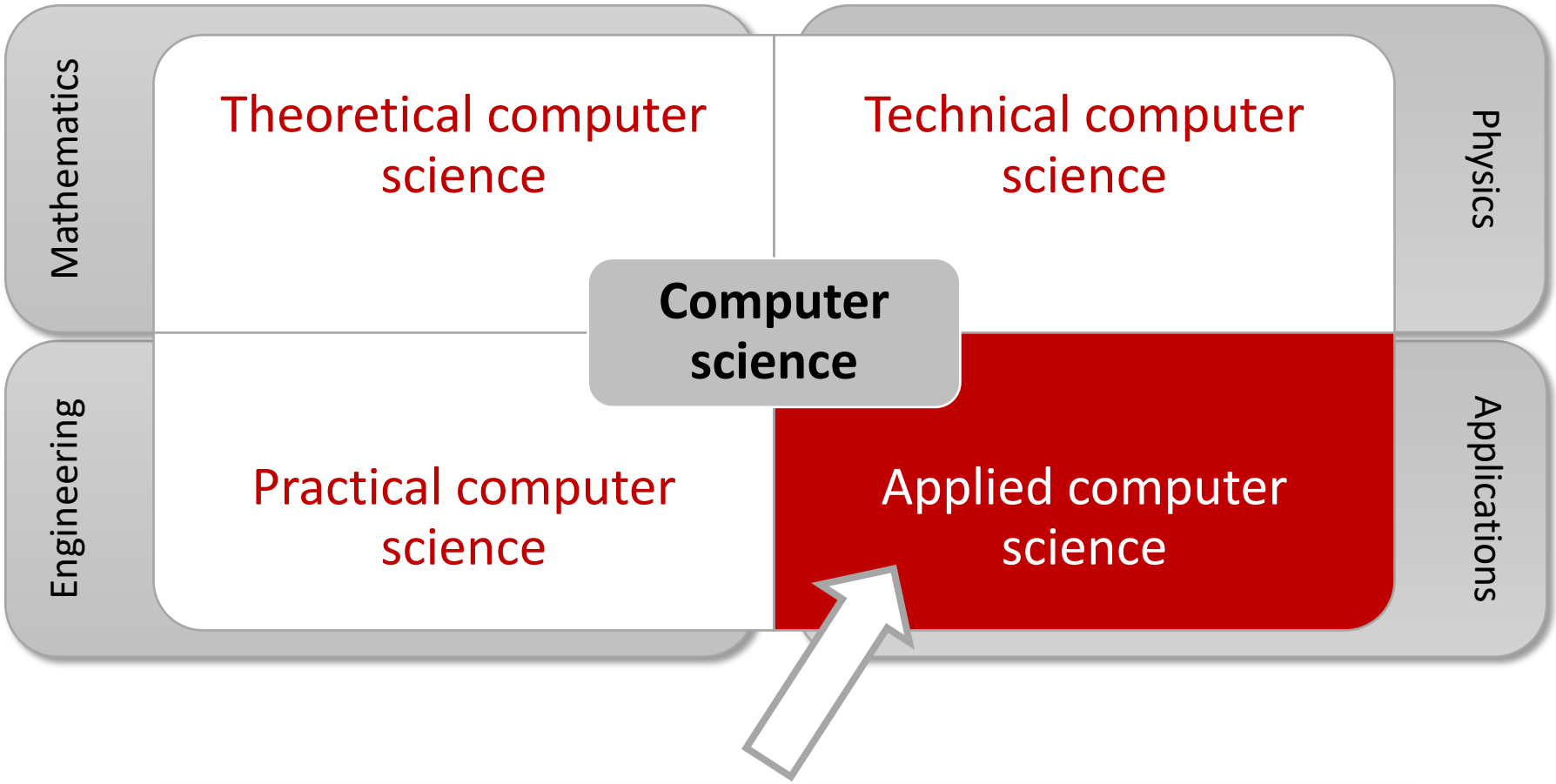
Discuss in Groups:

1. How do you define the task of a {X}?
2. What does {X} have in common with the others, what are the differences?

Subdisciplines in computer science



Subdisciplines in computer science

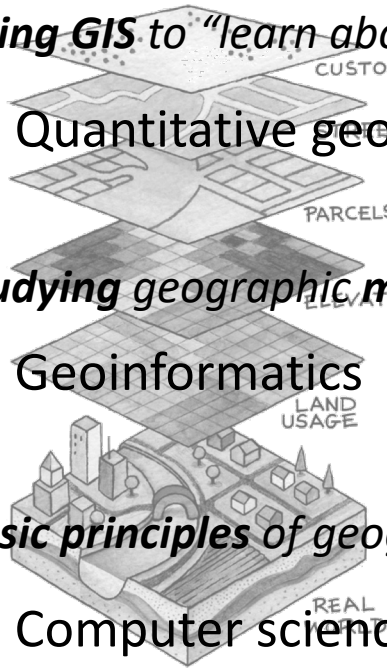


Adapting/Applying computer science to solve domain-specific questions
e.g. **Geoinformation Science**, bioinformatics, …

GIS and Computer Science

Using GIS *to "learn about the world."*

→ Quantitative geography



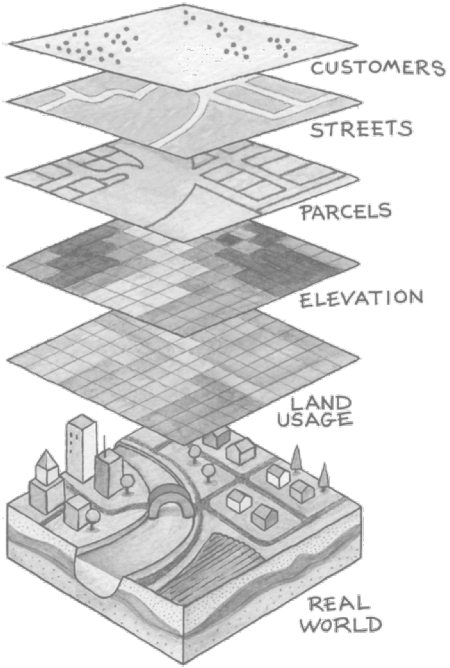
Studying *geographic* ***methods***, ***data structures***, *etc.*

→ Geoinformatics

Basic principles *of geographic methods, etc.*

→ Computer science

GIS and Computer Science



Using GIS to "learn about the world".

→ Quantitative geography

Studying geographic methods, data structures, etc.

→ Geoinformatics

Focusing on methods, data structures, etc.

→ Computer science

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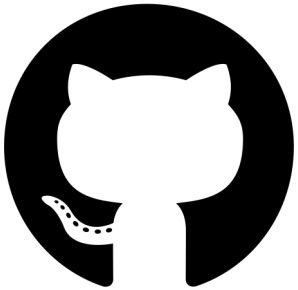
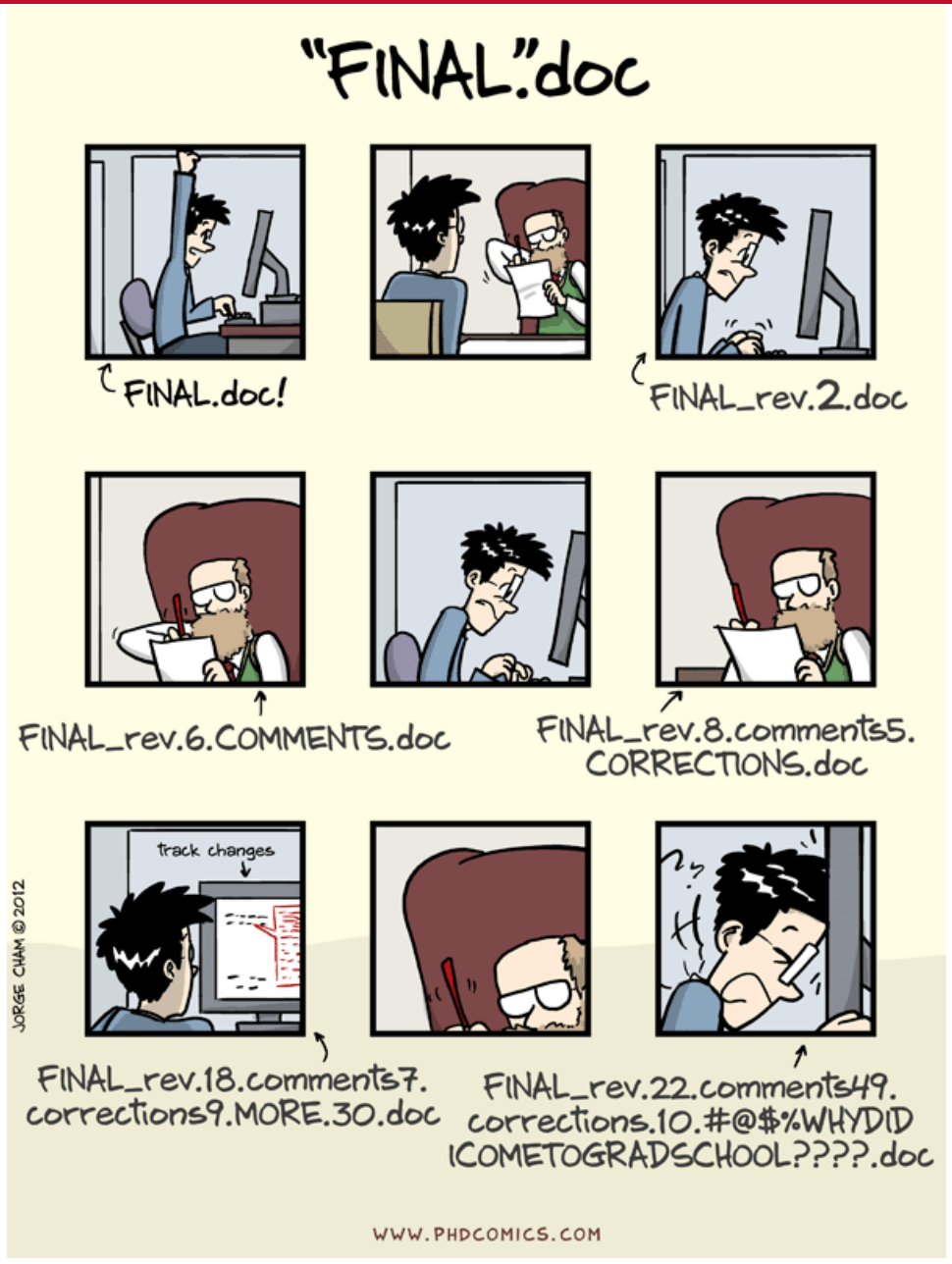
Course Material

All course material is on GitHub 

- **Git is a Version Control System** that tracks the changes made to computer files stored within a repository.
- Developed for **collaboration on open source software**

One concept…	**different implementations**
git	github, gitlab, bitbucket, …

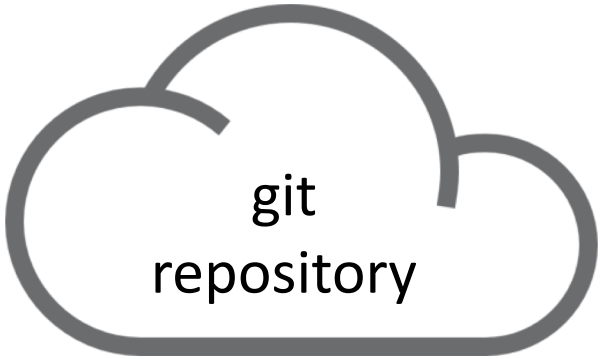
Why would you need git?



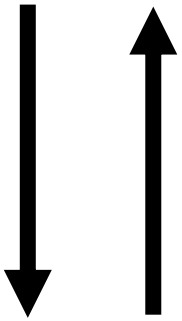
Concept of git

repository = ”repo”:
a directory containing all the files of your project whose changes should be tracked

“clone a repository”:
create a *local* copy of a repository on your computer and sync between the two locations



REMOTE
Server



Synchronizing changes (git pull)

LOCAL
computer

Local copy of the repository on your computer

Hands-On

Hands-On in Pairs!

Clone this git repository to your computers

→ https://github.com/redfrexx/cs4geos19

I will call this the

"course repository"

from now on.