# ORGANIZATIONAL CHANGES IN PANDEMIC AND POST-PANDEMIC TIME: CASE STUDY OF OBJECT-ORIENTED PROGRAMMING COURSE

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# Motivation

- Pandemic served as a catalyst to speed up inevitable processes of assessment automation
- Idea of the presentation is to
  - summarize experiences of changes in teaching and assessment process in the past few years
  - raise questions related to the purpose and organization of laboratory exercises and its alignment with legal and/or common policies

# shock → denial → finding workarounds → adjustment → mastering → ?

- 856 students (650 freshmen every year) enrolled in Object Oriented Programming in 2019/20
  - 4 hours/week of lectures, 1 hour/week of exercises, and 6x3 hours of laboratory exercises
  - Assessment of laboratory work partially automated using in house developed system Edgar* with quizzes and simple programming assignments

    * Mekterović, Igor ; Brkić, Ljiljana ; Milašinović, Boris ; Baranović, Mirta. Building a Comprehensive Automated Programming Assessment System // IEEE access, 8 (2020.); 81154 - 81172 doi:10.1109/access.2020.2990980

    - Two labs reviewed by teaching assistant at the end of exercise
- A typical initial reaction during pandemic usually had been shock and denial
  - Shock: What would be with the teaching process and what to do with exams (in that time written on paper)?
  - Denial: “We should just wait few weeks, and everything will be as usual”

# shock → denial → **finding workarounds** → adjustment → mastering → ?

- Mid-term exam cancelled, leaving only regular exams.
- Exams were written in the classroom as usual, but scanned afterwards and reviewed manually (tablet pen, annotations in PDFs, …) yielding first good practices:
  - No paper exam circulation among reviewers
  - Review insights using Microsoft Teams, avoiding usual scenes od 200+ students in the hall waiting to see their exams
- Lectures and exercises were recorded with live online consultations each week with some nice side effects
  - Font on the screen does not have to be increased as in a classroom, which means that more code fits on the screen
  - A lecture recording is not limited to 2 hours, which means that we were able to code more
- Assessment of laboratory exercises fully automated, but written from home
  - Pro: Finally, after many years there was no enormous lack of assistants which usually had to spend 500-1000 hours in the labs besides working on other tasks
  - Cons: Increase in points from the labs although the final pass percentage was not significantly different + lot of overhead for answering emails related to exercises

# shock → denial → finding workarounds → **adjustment** → mastering → ?

- 2020/21: Groups for lectures halved (to maintain distance) with recorded lectures as preparation for solving set of problems in the classroom and discussing it
- Laboratory exercises assessment fully automated solved in Edgar from home
  - repeated submissions limited to prevent trial-and-error strategy
    - problems with indeterministic tests including random, ordering in hashtables, …
  - ticketing system developed to reduce mail handling complexity
- Finding workarounds for some Edgar limits
  - prefix + code + suffix concept is not suitable for large tasks and requires that all classes are in one file
    - unclear compile errors with line number shifted for prefix with errors in suffix part
  - Bottlenecks at the end of test (frequent submissions)

=> Exams assessment automated using Gradle and Moodle for distribution and submission

  - graded locally by students repeating the same process later for official results

# shock → denial → finding workarounds → adjustment → **mastering** → ?

- 2021/22 – onwards
- Lectures as usual but now we have bunch of additional materials
- Quizzes with 5 multiple questions are now limited to 5 minutes with forward-only option (cannot go back)
- Tweaking thresholds focusing on the exam
  - Points for laboratory exercises lowered from 50% to 20%, valid only for mid-term and final exam (and not for later exams)
- Newly developed system for exam assessment further improved
  - trying to avoid test decompilation, simplifying distribution and submission (avoiding Moodle), possibility to log network changes, and various computer parameters
- For pprogramming assignments with class modelling, unit test uses reflection to ensure that merged code can be compiled

# How people usually imagine laboratory ?


A CHEMISTRY LABORATORY

Source:
https://commons.wikimedia.org/wiki/File:Chemistry_Laboratory_-_Bench.jpg

# How people usually imagine laboratory ?

## AN ATMOSPHERIC PHENOMENA LABORATORY

- Source: https://www.fer.unizg.hr/lvn/galerija

# How people usually imagine laboratory ?

## A LABORATORY OF ELECTRICAL MACHINES

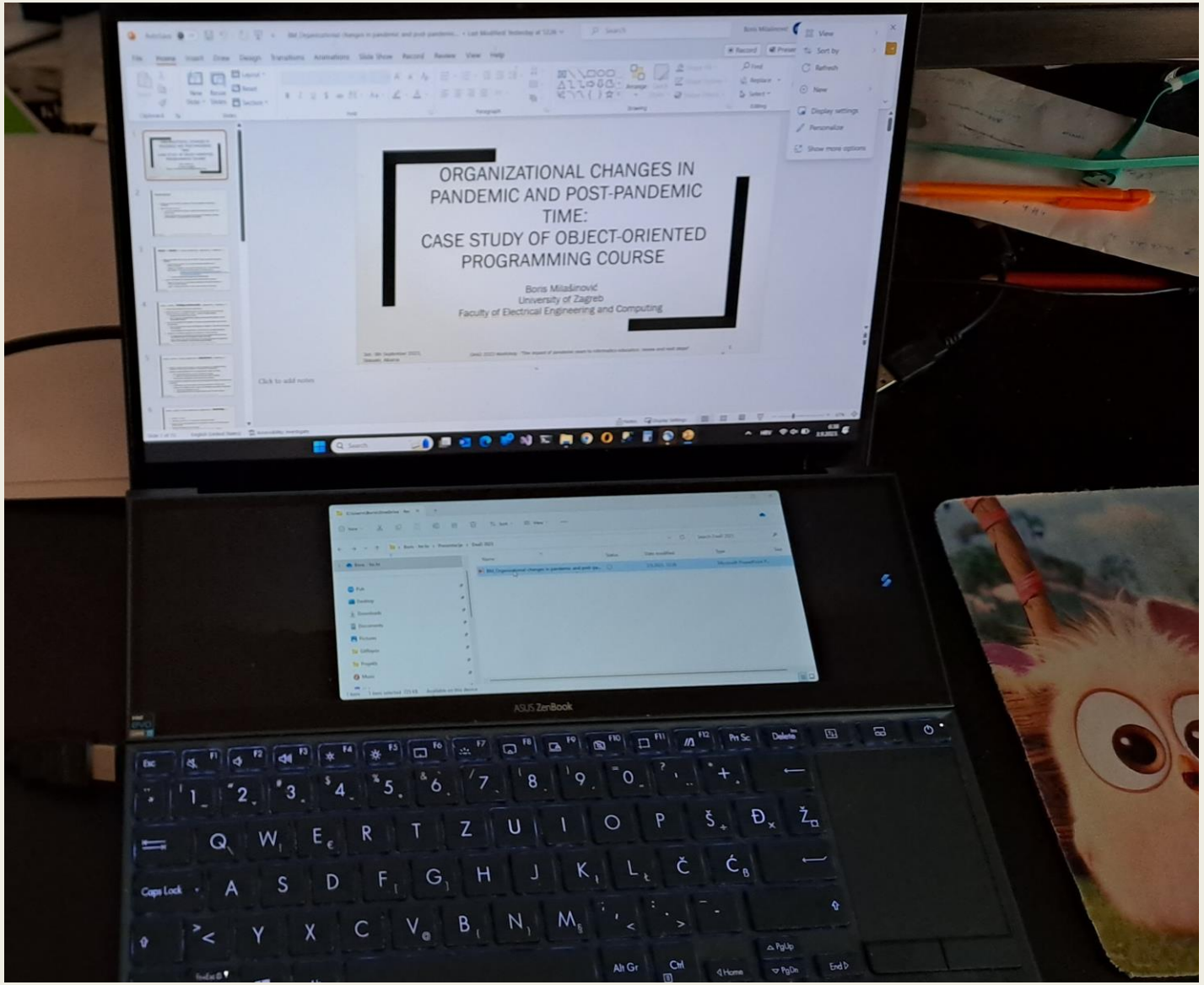
- Source: https://www.fer.unizg.hr/zesa/sk

# How people usually imagine laboratory ?

## A PROGRAMMING LAB

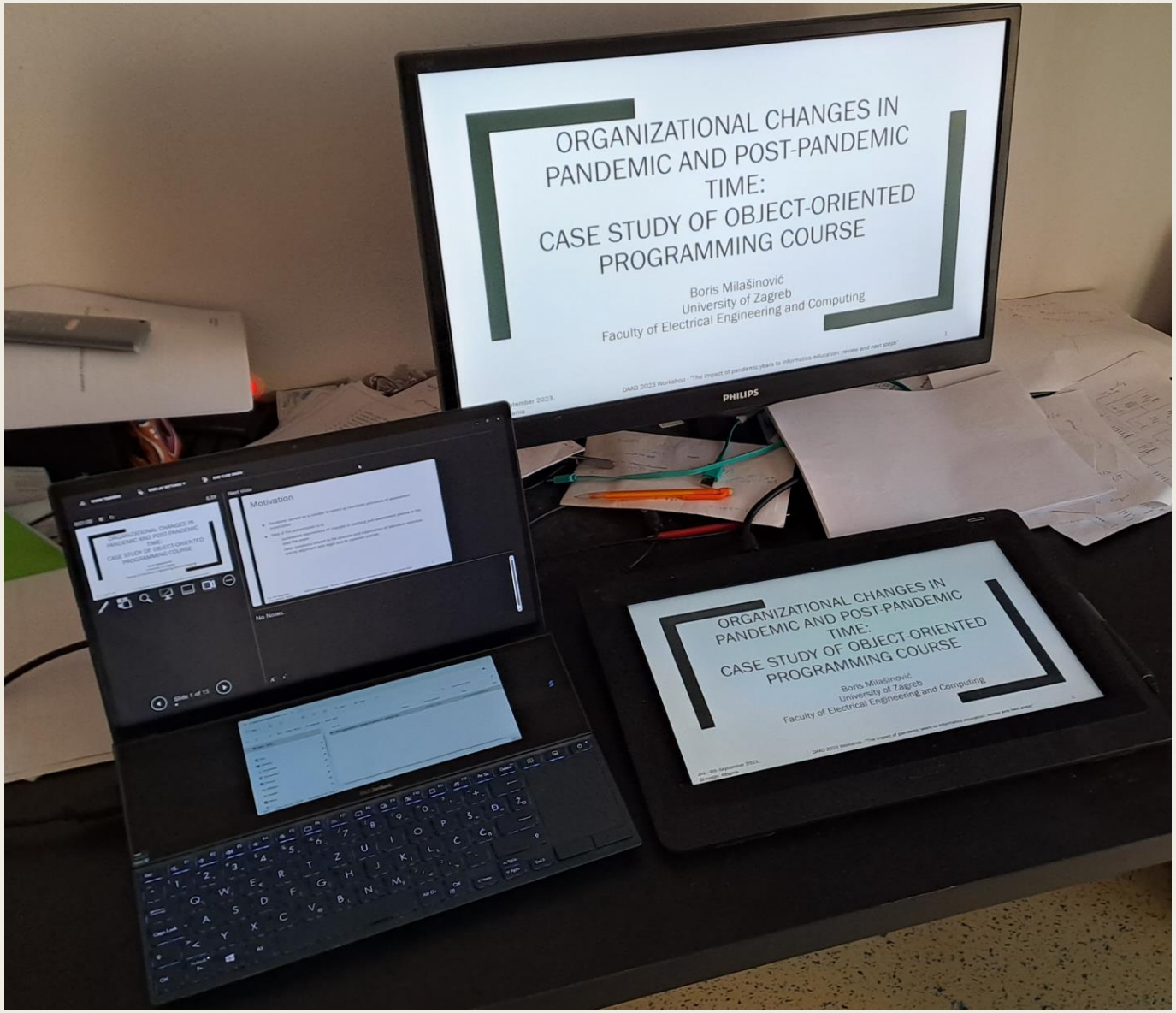
- Source: https://studentski.hr/studenti/vijesti/na-fer-u-otvorena-dva-nova-racunalna-laboratorija

# How people usually imagine laboratory ?




A HOME LAB?

# Laboratory exercises from home?




New possibilities

- Familiar environment?
- Snacks, drinks?
- Possibility to walk around and relax?

What is missing?

- Noise and distraction from other students?
- Dirtiness on keyboard and mouse?
- Teacher/assistant for **help and/or supervision**?
- Legal basis?

# Key questions (1)
# What is the purpose of going physically into the lab?

- Side effect to force a student to work continuously
  - Is it our job to do that?
  - Should students get some points for such labs?
- Hands on labs?
  - What can be done in 2 or 3 hours depends on type of topic and level of study
  - May have sense in introductory courses
- Questioning student upon successful tasks solving
  - Most of them are finished near the end of the lab (to little time to ask everyone)
- Review of the homework
  - It can be done remotely e.g. using Teams (with all pros and cons)
- Supervision during tasks solving and automatic review?
  - Teaching assistant acts as a doorman

# Key questions (2)
# Legal/Policy issues: No lab - no work?

- How collective agreement measures work in Croatia?
- With contact-hours (time spent in the classroom/lab) converted to hours of work to reach 810 professor hours or 405 assistant hours a year
  - 1 contact-hour of lectures = 5,4 hours of work in total
  - 1 contact-hour of exercises = 2,7 hours of work in total
- Contact hour contains ex ante + ex post tasks (preparations, consultations, exams, …) + indirect activities
- Preparation of one version of the exam usually takes 5 man x days
  - 2 versions for mid-term exam, 2 versions for final exam, 4 versions for exams in June/July, 2 versions exams in September

  => 10 x 5 x 8 hours + time for insights and administrative job > time spent on labs in total
- What happens if students solve the lab from home? Is ticket handling during the automatic assessment same as going in the lab? How much is worth “Doorman job” if someone else prepared tasks?

# (Instead of) conclusion

- We found that we can automate assessment process very successfully without affecting passing percentage or grade distribution
  - Time spent on exam preparation increased dramatically due to complexity of tests and tasks' structure, however usually in total it consumes less time in contrast to manual reviewing process
- Besides lack of supervision, we still have no mutual agreement on the purpose of the labs and number of points awarded to them
- Courses with project-oriented exercises will continue to have a problem of work evaluation
  - If we introduce homework instead of labs, formally our work could not be measured any more even if the real work is the same

# Questions/Discussion?

- Thank you for your attention