Concurrency:
State Models & Design Patterns

Practical Session

Week 01
First things first...
Please ensure that...

... you have carefully read the "PLEASE READ THIS FIRST" on the course web page.
... you have registered on Academia for the course.
... you have registered on Piazza.
... you always submit your solutions before the deadline.
... you are aware that the exercises account for 30% of your final grade.
... you ask questions whenever something remains unclear.
... you do not miss the two (mandatory) labs.

... you behave unlike a copycat!
You have to **attend the lecture to reveal such slides.**

*Disclaimer:*

*The content that has been shown on this slide is irrelevant for the exam.*
Assignment 01
Exercise 01 - Task 1 (7 pts)

a) Do recent central processing units (CPUs) of desktop PCs support concurrency? Why became concurrency for many software applications very important these days?

b) Why do we need synchronization mechanisms in concurrent programs?

c) What is safety? Give one concrete example of a safety violation.

d) What is liveness? Give a concrete example of a liveness violation.

e) Can a binary semaphore lead to a deadlock? Why? Can it lead to starvation? Why?

f) How do monitors differ from semaphores? Please provide a precise answer.

g) How are monitors and message passing similar? How are they different?
Exercise 01 - Task 2 (2 pts)

\[
x := 1
\]
Thread 1 -> \( x := x + 7. \)
Thread 2 -> \( x := x * 5. \)

**Considering the code above:** Give all possible values of \( x \) at the end of the execution of both threads with their corresponding execution traces.
Exercise 01 - Task 3 (1 pt)

Implement a monitor using a binary semaphore. Use pseudo-code and comment it.