University of Gdańsk

Subject card

Subject name and code	Concurrent Programming: Theory and Practice, PG_00204310						
Field of study	Informatics						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2026/2027			
Education level	Bachelor's studies		Subject group	Optional subject group			
Mode of study	part-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	Polish			
Semester of study	6		ECTS credits	8.0			
Learning profile	academic		Assessment form	exam			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Andrzej Nowik				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		0.0		0.0	60
Subject objectives	The aim of the course *Concurrency in Theory and Practice* is to familiarize students with the theoretical foundations of concurrency and their practical application in the design and implementation of concurrent systems, with particular emphasis on synchronization, communication, and the analysis of problems such as deadlocks and race conditions in threads and processes.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[INFL3_U03] can design and analyze algorithms for their correctness and computational complexity using appropriate algorithmic techniques and data structures	W01 The student knows and understands the issues of concurrent programming (basic concepts and models of concurrency, i.e. processes, threads, critical sections, synchronization, communication, etc.). W02 The student knows and understands methods of synchronization and communication between processes and threads, as well as concurrency problems such as deadlocks, starvation, etc. W03 The student knows and understands the principles of analyzing concurrent programs in terms of efficiency and safety. W04 The student knows and understands selected concurrent algorithms. Skills U01 The student is able to program concurrently. Social competences K01 The student is ready to apply the acquired knowledge in professional life.	[SU5] implementation of a problem task [SU8] observation of student's independent or team work
[INFL3_W02] has knowledge of discrete mathematics and probabilistic methods and statistics	W01 The student is able to apply discrete mathematics to analyze the correctness of concurrent programs.	[SW4] test/exam - oral or written [SW5] implementation of a problem task

Subject contents

* Classic problems of concurrency
* Process synchronization mechanisms in centralized and distributed models: semaphores (mutexes), monitors,
* The concept of events,
* Distributed algorithms: mutual exclusion, consensus, etc.
* Correctness of concurrent programs and its verification
* Applications of Petri nets in the analysis of concurrent programs
* CSP notation (language).
* MPI protocol.

Prerequisites and co-requisites

Algorithms and Data Structures;
Fundamentals of Programming;
Object-Oriented Programming;

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Computer lab	51.0%	30.0%
Exam	51.0%	70.0%

Recommended reading

Basic literature

1. M. Ben-Ari, ``Fundamentals of Concurrent and Distributed Programming", WNT 2009.
2. W. Iszkowski, M. Maniecki, ``Concurrent Programming", WNT 1982.
3. Andrew Troelsen, ``Pro C# 9 with .NET 5: Foundational Principles and Practices in Programming", Apress 2021.
4. Zbigniew Weiss, Tadeusz Gruźlewski, ``Concurrent and Distributed Programming in Examples and Exercises", WNT 1993.

Supplementary literature

1. M. Ben-Ari, ``Fundamentals of Concurrent and Distributed Programming", WNT 2009.
2. W. Iszkowski, M. Maniecki, ``Concurrent Programming", WNT 1982.
3. Andrew Troelsen, ``Pro C# 9 with .NET 5: Foundational Principles and Practices in Programming", Apress 2021.
4. Zbigniew Weiss, Tadeusz Gruźlewski, ``Concurrent and Distributed Programming in Examples and Exercises", WNT 1993.

	eResources addresses	
Example issues/ example questions/ tasks being completed	Examples of the Banker's Algorithm Dekker's Algorithm	
Work placement	Not applicable	

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