POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Introduction to computing [S1SI1E>WdI]

Course

Field of study
Artificial Intelligence

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

High school level knowledge is required.

Course objective

The subject introduces basic concepts in computer science and demonstrates their usefulness in practice.

Course-related learning outcomes

Knowledge
K1st_W2 has structured, theoretically supported basic knowledge regarding key areas of computer science

Skills
K1st_U2 has basic IT skills
K1st_U14 is able to use information and communication techniques and tools at various stages of implementation of IT projects

Competencies
K1st_K1 understands that in IT, with particular emphasis on artificial intelligence, knowledge and skills

become obsolete very quickly, recognizing the need for continuous education and improving one's own competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: multiple-choice test during the last classes, pass mark: 50% Laboratories: entrance tests that evaluate the knowledge from the previous classes (to pass the course you need to pass all of them), points for exercises performed during the classes (entitling to a higher grade)

Programme content

1. Digital circuits
2. Low-level programming
3. Numerical methods
4. Text processing
5. Databases
6. Parallel processing

Course topics

The lecture covers the basics of digital circuits, including binary numbers and addition. It introduces Boolean algebra and its laws and explains how to convert a truth table into a Boolean function. The lecture also discusses logic gates, including NAND and NOR gates, and introduces the concept of universal gates. It covers memory devices, such as latches and flip-flops, and demonstrates how to use T flip-flops to create a 3-bit counter. Additionally, the lecture covers registers and multiplexers, which are used to select and forward data inputs.

The next lecture explores the history of computing, from ancient Greek analog computers to modern electronic and biological systems. It delves into foundational concepts such as binary arithmetic, hexadecimal numbers, and negative numbers. The lecture also examines CPU architecture, x86 assembly language, and conditional execution. Furthermore, it touches on DNA computing and quantum computing, highlighting their potential applications and challenges.

The following lecture addresses various aspects of numerical methods, including the representation of real numbers, numerical stability, polynomials, Maclaurin series, and Python libraries. It discusses the limitations of floating-point representation and the importance of understanding IEEE-754 standards. The lecture also covers loops and floating-point numbers, emphasizing the need for careful consideration when working with approximate values. Additionally, it introduces Horner's method for evaluating polynomials, Heron's algorithm for computing square roots, and the Maclaurin series for approximating functions. The lecture concludes with an overview of NumPy, SciPy, decimal, mpmath, fractions, and SymPy libraries, which provide powerful tools for working with numerical data.

The next lecture highlights the importance of text processing in data analysis, showcasing its applications in real-world examples such as web scraping and log file analysis. It introduces regular expressions and their syntax, demonstrating how to use them in Python and other tools like `grep`, `sed`, and `awk`. The lecture also covers character encoding, Unicode, and text processing libraries in Python, providing a comprehensive overview of the topic.

The subsequent lecture introduces the concept of databases and their use in storing and managing large collections of data. It begins by discussing the limitations of using AWK to process text files and introduces SQL (Structured Query Language) as a language to query and manipulate databases. The lecture covers the basics of SQL, including creating tables, inserting data, selecting data, and joining tables. It also explores advanced topics such as data types, filtering, and basic math operations. The lecture includes examples and demos to illustrate the concepts and provides an overview of the SQL language, its syntax, and its applications.

Parallel processing is essential in modern computing, from desktops to supercomputers. Single-core technology is reaching its limits, and many computational problems can be divided into subproblems. Real-world examples include gaming, big data analytics, and scientific computing. Parallel processing enables faster rendering, data processing, and simulation. Hardware, operating systems, and applications must be designed to take advantage of parallelism. Synchronization is crucial to avoid deadlocks, and various mechanisms like semaphores, locks, and condition variables are used to ensure correct execution. The lecture covers various topics, including time-sharing, scheduling, and future trends in parallel processing.

Teaching methods

Lecture: multimedia presentation
Laboratory exercises: performing tasks on lecture content with the help of online tools

Bibliography

Matthew Justice "How computers really work"
Dale Dougherty, Arnold Robbins "Sed & Awk"
Michael J. Fitzgerald "Introducing regular expressions"
Anthony DeBarros "Practical SQL: A beginner's guide to storytelling with data"

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50