Study program: Information Technology

Course title: COMPUTER ARCHITECTURE

Teacher(s): Uroš M. Pešović

Course status: mandatory

Number of ECTS credits: 6

Prerequisite courses: none

Course objectives

Learning the structure and way of working of the classical von Neumann computer, the types of operations and the data types they process; familiarization with the hierarchy of the computer's memory subsystem; familiarization with the principles of implementation of input/output operations and data transfer within the computer and between the computer and its environment; familiarization with aspects of computer architecture necessary for other areas of computer engineering such as program translators, operating systems and computer networks.

Learning outcomes

The student should know the principle of operation of the von Neumann computer and its basic functional units; explain different instructional formats; explain how instructions are executed and how they are represented at the machine level in the context of assembly languages; writes simple assembly programs; classifies memory components according to basic characteristics; describe the principles of memory hierarchy; describe the role of "cache" and virtual memory; explain techniques for input/output data transfer.

Content of the course

Theoretical classes

The basic structure of the von Neumann computer. Elements of Instructional Set Architecture. Representation of data types. Processor registers. Computer instruction format and addressing methods. Types of instructions (data manipulation, arithmetic and logical instructions, instructions for working with memory and stack, jump instructions, input/output instructions). Phases of instruction execution: fetching, decoding, finding operands and executing instructions. Subroutine calls and subroutine return mechanism. Machine and assembly programming. Memory system and characteristics of memory components. Memory hierarchy (organization of operational memory, "cache" memory and virtual memory). Input/output operations. Programmed input/output. Interrupt-controlled input/output. Direct memory access.

Practical teaching

Practical application and verification of acquired knowledge through solving tasks and writing assembler programs and execution on computer architecture simulators.

Literature

[1] David Patterson, John Hennessy, Computer Organization and Design - The Hardware/Software Interface: RISC-V Edition, Morgan Kaufmann; 1st edition, 2017, ISBN: 978-0128122754

[2] William Stallings, Organizacija i arhitektura računara: projekat u funkciji performansi, CET, Beograd, 2012, ISBN: 978-86-7991-361-6

[3] Јован Ђорђевић, Архитектура рачунара: едукациони рачунарски систем: архитектура и организација рачунарског система, Академска мисао, Београд, 2002, ISBN: 86-7466-090-8

[4] Andrew Tanenbaum, Arhitektura i organizacija računara, Mikro knjiga, Beograd, 2007, ISBN - 978-86-7555-314-4

[5] Noam Nissan, Shimon Schocken, The Elements of Computing Systems: Building a Modern Computer from First Principles, MIT Press, Second Edition, 2021, ISBN: 9780262539807

[6] Kip Irvine, Assembly language for x86 processors, 7th Edition, Pearson, 2014, ISBN: 978-0-13-376940-1

Number of active teaching classes: 4	**Theoretical classes: 2**	**Practical teaching: 2**

Teaching methods

Realization of lectures according to the model of interactive teaching with the use of practical work methods.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activities during teaching process	/	Final exam (written):	20
Practical teaching	10	Final exam (oral):	30
Colloquium	40		
Practical teaching			