POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR: 2020/2021

1. GENERAL COURSE INFORMATION				
1.1 Course name	**Algorithms and data structures**			
1.2 Study program/s	Undergraduate professional study in Computer Science			
1.3 Course status (O,E)	Obligatory	**1.6 Mode of instruction (number of hours)**	**Lectures**	30
1.4 Course code			**Exercises**	45
1.5 Course abbreviation			**Seminars**	
1.6 Semester	3		**E-learning**	
1.7 ECTS	7	**1.7 Place and time of instruction**	The premises of Polytechnic of Medjimurje in Cakovec, according to schedule published on web pages	
2. TEACHING STAFF				
2.1 Course leader/s-title	Dr.sc. Bruno Trstenjak, senior lecturer	**contact**		
		contact		
2.2 Assistant/s- title		**contact**		
		contact		
2.3 Instruction held by- title		**contact**		
3. COURSE DESCRIPTION				
3.1 Course goals	After completing the course, the student will be able to apply different data structures using different program algorithms. The student will be able to apply the acquired knowledge in the field of data structures and algorithms in the independent execution of program tasks.			
3.2 Prerequisites	Passed courses: Programming, Mathematics 1			
3.3 Course outcomes	After successfully completing the course, students will be able to: O1 - Explain the basic properties and characteristics of different data structures O2 - Explain how different simple and advanced programming algorithms work and recognize the complexity of the algorithm O3 - Make an analysis of the efficiency of individual algorithms in solving problem tasks O4 - Apply various data structures and algorithms in solving problem tasks O5 - Identify appropriate data structures and algorithms in solving specific problems			
3.4 Course content	The content of the course continues the acquired knowledge from the course in the course Programming. The most widely used algorithms and data structures are processed. After dynamic memory allocation, memory allocation examples, and function call mechanism, the notion of algorithm complexity is introduced. Recursion is explained and illustrated. The search techniques are continued and then all the important sorting algorithms follow. Dynamic data structures are introduced: single and multiple linked lists. Basic data structures such as hence and order are built. Then the diffuse addressing technique, binary			

	trees and binary search tree are introduced. Application of data compression algorithms and search of character and numeric data strings.

3.5 Types of coursework

X	Lectures	X	Exercises		Blended e-learning	X	Individual activities		Laboratory
	Seminars and workshops	X	Distant learning		Field classes		Multimedia and network		Mentorship
	Other								

3.6 Language of instruction

3.7 Monitoring students' work (enter the number of ECTS credits for each activity so that the total number of ECTS credits is equal to the total ECTS value of the course, 1 ECTS = 30 hours)

2,5	Class attendance	0,5	Seminars		Essay
	Class activity		Project		Report/paper
3,0	Midterm exams		Practical task		Continuous knowledge check
	Written exam		Experimental work		
1,0	Oral exam		Research		

3.8 Assessment and evaluation of students' work during classes and at the final exam

Activity specification	Percent %	Points
Assessment during instruction		
Attendance	5%	5
Continuous assessment	20%	20
Seminar/ project/ essay	5%	5
Midterm exam 1	15%	15
Midterm exam 2	15%	15
Midterm exam 3	15%	15
Oral exam	25%	25
Exam assessment for the students who failed to fullfil all the obligatory requirements during the semester		
Written exam	*45%*	*45*
Total:	**100%**	**100**

3.9 Assessment criteria – analysis per learning outcomes

Ways of evaluating learning outcomes								
	Attendance	**Continuous asse.**	**Mid-term exam 1**	**Mid-term exam 2**	**Mid-term exam 3**	**Seminar**	**Oral exam**	**Total**
Outcome 1			5				5	10
Outcome 2		5	10	5			5	25
Outcome 3		5		10			5	20
Outcome 4		5			5		5	15
Outcome 5		5			10		5	20
Outcome not-related	5					5		10
Total	5	20	15	15	15	5	25	100

Grading of outcomes (in order to pass the mid-term exam/exam the student must achieve at least 50% points for each learning outcome)

Points	Grade
89 – 100	excellent (5)
76 – 88	very good (4)
63 – 75	good (3)
50 – 62	pass (2)
0 – 49	fail (1)

3.10 Specific features related with taking the course	If a student collects 50% of the points of each outcome, he / she directly takes the exam, if he / she has submitted a seminar paper. A student cannot access the exam if he / she has not submitted a seminar paper. Seminar papers are prepared according to the instructions published on the Merlin system and are submitted by posting on the Merlin. The seminar paper should be submitted at least 3 days before the exam deadline.	
3.11 Students obligations	Full-time students are required to attend at least 70% of the total number of hours of lectures and exercises in order to exercise the right to take the exam. Part-time students are required to attend at least 30% of the total number of hours of lectures and exercises in order to exercise the right to take the exam. If the student has not fulfilled all the obligations set by the course, he is obliged to attend the lectures again and meet the conditions for taking the exam. Attendance can be offset by online tuition, organised webinars and added assignments given by teachers. One lesson lasts 45 minutes, and several hours form a teaching unit. Absence from one teaching unit is counted as one absence. Delays and apologies are recorded separately. In that case, if the student missed more than 50% of classes, and has a justifiable reason/apology, the request should be submitted to the Department Council, which then decides on the justification of student absences with the obligatory opinion of the course leader.	
3.12 Written assignments		
3.13 Required reading	1.	Dr. Clifford A. Shaffer: Data Structures and Algorithm Analysis in C++,Dover Publications, 2011.
	2.	
3.14 Additional reading	1.	Henry H Liu: Algorithms with Implementations in C: A Quantitative Approach, Independently published, 2019.
	2.	Adam Drozdek: Data Structure and Algorithm in C++, Cengage Learning India, 2013.
4 ADDITIONAL COURSE INFORMATION		
4.1 Quality control	The quality of the program, teaching process, teaching skills and level of mastery of the material will be established by conducting a written evaluation based on questionnaires, and in other standardised ways and in accordance with the by-laws of the Polytechnic of Međimurje in Čakovec.	
4.2 Contact the teacher	Students can contact the teacher during the office hours and during classes, while for short questions and explanations they can contact him/her any day during working hours by coming in person or by landline. It is also possible to ask questions by e-mail, which will be answered in 48 hours at the latest. It is desirable for students to come as often as possible for any possible questions during the teacher's office hours.	
4.3 Information about the course	It is the obligation of each student to be regularly informed about the course. All notifications about the classes or possible postponement of classes will be posted on the bulletin board and on the website of the Polytechnic at least 24 hours in advance.	

4.4 Course contribution to the study program	- Develop programming code in multiple programming languages using modern methods and tools - Choose ways of structuring data in program code, as well as techniques for writing complex program forms and use standard algorithms

5. ANALYSIS OF COURSE TOPICS (the number of hours is equal to the number of lectures and exercises of the course)

LECTURES

Hours	Topic and description	**Method** • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…	Learning outcomes	Course outcome
1. & 2.	Introduction to the course content, teaching methods, evaluation of student work during the semester Basic concepts of the concept of data structure and algorithms	Lecture, discussion, PP presentation	Explain the basic properties and characteristics of different data structures.	O1
3. & 4.	Basic concepts: data structures and algorithms (ways to measure the performance of algorithms)	Lecture, discussion, PP presentation	Explain the basic division of algorithms, how to evaluate the performance of the algorithm.	O1
5. & 6.	Data structure: class and object	Lecture, discussion, PP presentation	Explain the basic properties of the class, know how to create a class according to the problem task.	O1
7. & 8.	Lists as a data structure	Lecture, discussion, PP presentation	Explain the basic properties and characteristics of a list as a data structure.	O1,O2
9. & 10.	Queue and stack	Lecture, discussion, PP presentation	Explain the basic properties and characteristics of the queue as a data structure, explain the differences between the queue and therefore.	O1,O2
11.&12.	Midterm exam 1	Individual work	Outcome check O1, O2	
13.&14.	Tree structure, binary search tree	Lecture, discussion, PP presentation	Explain the basic properties of a	O1,O2,O3

			binary tree. Explain the tree tour algorithm.	
15.&16.	Recursion	Lecture, discussion, PP presentation	Explain the concept of recursion, properties of recursion, explain how to perform a simple example of an algorithm based on recursion.	O2,O3
17.&18.	Data sorting	Lecture, discussion, PP presentation	Explain the basic properties of data sorting algorithms.	O2,O3
19.&20.	Midterm exam 2	Individual work	Outcome check O2, O3	
21.&22.	Graphs	Lecture, discussion, PP presentation	Explain the concept of graphs, identify types of graphs and apply a graph search algorithm.	O2,O3,O4
23.&24.	Data compression	Lecture, discussion, PP presentation	Explain the basic properties of a data compression algorithm. Enumerate and explain how to perform a particular compression algorithm to mathematical problems.	O2,O3,O4
25.&26.	Associative data storages	Lecture, discussion, PP presentation	Explain the concept of associative data storage, the choice of application of a particular structure depending on the problem task.	O2,O3,O4
27.&28.	Search algorithms	Lecture, discussion, PP presentation	Enumerate search algorithms. Explain how to execute the algorithm according to the problem task.	O2,O3,O5
29.&30.	Midterm exam 3	Individual work	Outcome check O4, O5	
EXERCISES/ SEMINARS				
Hours	**Topic and description**	**Method** • Direct teaching (lecture, instruction, pp presentation)	**Learning outcomes**	**Course outcome**

		• Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…		
1. - 3.	Introduction to a development tool for writing algorithms and data structures.	Lecture, discussion, PP presentation	Explain how to use tools for testing algorithms and data structures.	O1
4. - 6.	Classes and objects	Presentation, independent work	Apply the basics of class development. Create simple applications using classes and objects.	O1
7. - 9.	Classes and objects (application)	Individual work	Develop a simple application with class application according to the problem task.	O1,O2
10 – 12	Lists as a data structure	Presentation, independent work	Explain how to implement the structure and algorithm for working with List. Upgrade the programming structure in C ++.	O1,O2
13 – 15	Queue and stack	Presentation, independent work	Explain how to implement the structure and algorithm for working with queue and stack. Upgrade the programming structure in C ++.	O1,O2
16 – 18	Tree structure, binary search tree	Presentation, independent work	Explain the implementation of the tree structure. Upgrade the structure according to the given properties.	O2,O3
19 – 21	Recursion	Presentation, independent work	Explain how a recursive algorithm works.	O2,O3
22 – 24	Data sorting	Individual work	Measure the properties of an individual sorting algorithm, compare the efficiency of the algorithm (Big O notation).	O3

25 – 27	Graphs	Presentation, independent work	Explain the implementation of the graph structure. Upgrade the structure according to the given properties.	O3,O4
28 – 30	Data compression	Presentation, independent work	Upgrade the data compression algorithm, measure the efficiency of the algorithm.	O3,O4
31 – 33	Associative data storages	Presentation, independent work	Explain the implementation of structure and algorithms. Upgrading existing algorithms.	O3,O4
34 – 36	Associative data storages (application)	Individual work	Implement an indexed associative container according to default properties.	O4,O5
37 – 39	Search algorithms - numbers	Presentation, independent work	Explain the individual search algorithm.	O2,O3,O4
40 – 42	Search algorithms - string	Presentation, independent work	Explain the individual search algorithm.	O2,O3,O4
43 – 45	Search algorithms (application)	Individual work	Apply the algorithm according to the problem task.	O5