RĪGAS TEHNISKĀ UNIVERSITĀTE

RTU Course "Data Structures"

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General data

Code	DIP203
Course title	Data Structures
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Aleksejs Jurenoks
Academic staff	Natālija Prokofjeva Igors Ščukins Lāsma Lēruma Padmaraj Nidagundi Valdis Saulespurēns Inese Simkeviča
Volume of the course: parts and credits points	1 part, 4.5 credits
Language of instruction	LV, EN
Annotation	The study course provides the following information: data structure (DS) concept and classification, logical and physical data structures, DS creation methods and representation techniques. The study course covers linear data structures (arrays, lists, tables, stacks, rows, dequeues) and nonlinear data structures (trees, graphs), as well as describes several types of lists and trees, their specification, representation, creation and use.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to provide knowledge and skills about data type and data structure (DS) specifications, data structure creation methods and representation techniques, and efficient algorithms for working with frequently used data structures. Tasks of the study course: - to acquaint students with the concept, meaning and classification principles of data structures, as well as the development and description of DS model, design and implementation; - to teach students to choose the most efficient DS and their processing algorithms and to use them in practice in the software development process.
Structure and tasks of independent studies	Individual work consists of: - study of methodological materials and literature; - completion of laboratory works („Processing of special arrays", „Processing of lists", „Semi-static data structures").
Recommended literature	Obligātā/Obligatory: 1. A Common-Sense Guide to Data Structures and Algorithms, 2e: Level Up Your Core Programming Skills. The Pragmatic Programmers; 2nd ed. edition, 2020. 250 p. 2. Herbert Schildt. Java: beginner's guide. 8th edition NewYork, McGraw-Hill, 2018. 720 p. 3. Gregoire Marc. Professional C++. Wrox; 5. edition, 2021. - 1312 p. 4. Lassoff, Mark. Introduction to Python 2018 edition. New Haven, CT : LearnToProgram, 2018. - 220 p. 5. Scott L.M. Programming Language Pragmatics. 4th Edition. Morgan Kaufmann, 2015. – 992 p. 6. Gunārs Matisons. Datu struktūras. Lekciju konspekts. – Rīga: RTU Izdevniecība, 2008. – 192 lpp. Papildu/Additional: 1. J. Kopitovs, S. Ivanova. Datu strukūras un algoritmi: mācību grāmata. 3. labotais izd. – Rīga: Transporta un sakaru institūts, 2005. – 96 lpp. 2. Mark Allen Weiss. DATA STRUCTURES & ALGORITHM ANALYSIS IN JAVATM. Florida International University, 1999. 3. Вирт Н. Алгортмы и структуры данных / Пер. с англ. – М. Мир, 1989, 360 с. 4. Open Data Structures (An open content textbook). Available from: http://opendatastructures.org/ 5. Data Structures. Available from: https://www.geeksforgeeks.org/ 6. Algorithms and Data Structures. Available from: http://www.algolist.net/Algorithms/ 7. Visualising Data Structures and Algorithms Through Animation (VisuAlgo). Available from: https://visualgo.net/en 8. Data Structure Visualizations. Available from: https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
Course prerequisites	Algorithmization and Programming of Solutions.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
The aim and tasks of the study course. Data structure definition. Data type concept. Data structure classification.	5	5	0	0
Data type classification. Pointers, references. Arrays, their types, specification, representation and creation. Records, variant records. Strings. Tables. Files.	5	5	0	0
Special arrays and their use. Diagonal matrix, triangle matrix, symmetric matrix, sparse matrix.	5	5	0	0

Algorithm concept and properties. Algorithm efficiency criteria: time, complexity. Sorting concept. Classification of sorting algorithms. String search algorithms.	5	5	0	0
The concept and types of linear data structure. Lists, their characteristics and processing operations. List displayed in vector form.	5	5	0	0
Linked list. Doubly linked list. Circular list. Multi-linked list. Ordered list.	5	5	0	0
Stack. Stack specification, representation and creation.	5	5	0	0
Queue. Creating a circular queue. The dequeue concept.	5	5	0	0
The concept and characteristics of a tree data structure. Tree classification. Types of classification of binary trees, representation and principles of creation. Binary tree traversal.	5	5	0	0
Binary search tree. AVL tree. Balance factor of AVL tree. Types of AVL rotations.	5	5	0	0
Heap. Heap conditions. The concept and use of B-tree.	5	5	0	0
Graph concept. Graph traversal and its implementation methods. Graph representation techniques.	5	5	0	0
Total:	60	60	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Is able to create data structures and implement their processing operations.	Independently performed and positively evaluated laboratory works.
Is able to create various types of data structures, describe and implement the functions for their processing.	Independently performed and positively evaluated homework.
Knows general questions about data structures, their representation models, specifications, and processing operations.	Completed and positively evaluated tests.
Knows the concept, meaning and classification principles of data structures, as well as types and technologies for representing data structures.	Passed the exam with a positive grade.

Evaluation criteria of study results

Criterion	%
Laboratory works	30
Homework	20
Tests	10
Exam	40
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	4.5	2.0	0.0	1.0		*	