RĪGAS TEHNISKĀ UNIVERSITĀTE

RTU Course "Discrete Structures of Computer Science"

12309 null

General data

Code	DSP202
Course title	Discrete Structures of Computer Science
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Computer Science
Responsible instructor	Jānis Grundspeņķis
Academic staff	Judīte Ciekure Raisa Smirnova Vita Šakele
Volume of the course: parts and credits points	1 part, 3.0 Credit Points, 4.5 ECTS credits
Language of instruction	LV, EN
Annotation	During their studies students acquire the practical applications of discrete mathematics concepts, graph algorithms and mathematical foundations of data base. Students acquire the properties of binary relations by detailed examination of equivalence and ordering. Students acquire key elements of graph theory, ways of graph representations. Theoretical knowledge has to be used by practical calculations with shortest path algorithm; algorithm for minimal spanning tree and algorithm for maximum flow problem. The course also observes basic concepts of relational database, operations of relational algebra and basics elements of Structured Query Language (SQL). While studying the subject students have to work out course work; they have to write a program that solves the defined task by using algorithms and concepts given in lectures.
Goals and objectives of the course in terms of competences and skills	The goal of the course is to get skills of practical applications of such concepts of Discrete Mathematics as relations, mappings and ordering, so that at the end of the course students will be able to analyse properties of relations and to create mappings with various properties. After the course a student has to understand concepts of Graph theory, know graph representations and has to be able to apply the following graph algorithms: Dijkstra's algorithm, Prim's algorithm and Ford-Fulkerson algorithm. Students have to understand basic concepts of relational database, have to be able to implement relational operations with data base tables and to form query for the relational database.
Structure and tasks of independent studies	While studying the subject students have to work out course work (CW). The CW includes five tests and 2 practical works.
Recommended literature	Pamatliteratūra - Rosen K.H. Discrete Mathematics and its Applications, McGraw-Hill, Inc .1991. Grāmata satur visu dotajā priekšmetā vajadzīgo mācību materiālu. Tajā īpaša vērība ir veltīta diskrētās matemātikas praktiskiem lietojumiem. - Strazdiņš I. Diskrētās matemātikas pamati, Zvaigzne, Rīga, 1980. Grāmata aptver plašu diskrētās matemātikas jautājumu loku, kas aprakstīts no teorētiskā redzes viedokļa. Grāmata prasa samērā labu matemātisko sagatavotību, tādēļ bakalauriem varētu būt grūti uztverama. Ieteicamā literatūra - Dambītis J. Modernā grafu teorija, Datorzinību centrs, 2002. Grāmatā aprakstīti grafu teorijas pamati. - McHugh J.A. Algorithmic Graph Theory, 1990. Grāmatā grafu teorija apskatīta no algoritmiskā redzes viedokļa. Tā satur visus svarīgākos grafu algoritmus. - J. Grundspeņķis. Grafu teorijas pamati, Rīgas Politehniskais institūts, Rīga, 1976. Mācību līdzeklī apskatīti grafu teorijas pamatjēdzieni, grafa raksturīgie lielumi, speciāli grafu veidi un grafu un matricu savstarpējais sakars. - Кристофидес Н. Теория графов. Алгоритмический подход., Москва, Мир, 1978. Grāmatā ir visu šajā lekciju kursā apskatīto grafu algoritmi un to realizācijas piemēri.
Course prerequisites	Fundamental concepts of set theory: set, subset, set operations (union, intersection, difference).

Course outline

Theme	Hours
Relations and their types. Properties of relations. Special types of relations.	6
Comparing elements in ordered sets. Lexicographic ordering.	2
Relations and graphs. Types of graphs	2
Graph representations (static and dynamic representations).	4
Mappings, their representation and types.	4
Path searching in graphs (backtrack search).	2
The shortest path problem. Dijkstra's algorithm. Floyd's algorithm.	4
Trees and their properties. A spanning tree of graph. Prim's algorithm and Kruskal's algorithm. Decision tree.	6

Tree traversal algorithms. Universal address system. Prefix, postfix, and infix notation. Prefix codes.	4
Networks. Topological sorting. Transportation networks. The flow conservation equation. Ford-Fulkerson algorithm.	4
Relations and data bases. Operations of relation algebra. Procedure of table computation.	6
Formal languages of relation algebra and relation calculus. Structured Query Language. Defining data and data management	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students are able to to analyse properties of relations and to use special types of relations for description of real problems.	Students are able to pass the test "Equivalence" and correctly answer the questions of the 1st section of the theoretical part of examination.
Students are able to show graph representations.	Students are able to pass a practical work "Graph representations"and correctly answer the questions of the 3rd section of the theoretical part of examination.
Students are able to apply graph algorithms.	Students are able to do 3 home works and correctly answer the questions of the 3rd section of the theoretical part of examination and solve the 2nd task of the practical part of examination.
Students are able to determine different types of mapping and to create mappings with various properties.	Students are able to do practical work "Mapping" and correctly answer the questions of the 2nd section of the theoretical part of examination.
Students are able to apply the tree traversal algorithms to obtain prefix, postfix notation and to calculate its value.	Students are able to accomplish practical work "Trees" and correctly answer the questions of the 4th section of the theoretical part of examination.
Students are able to apply operations of relational algebra and to form query for relational database.	Students are able to accomplish practical work "Databases and relations" and correctly answer the questions of the 5th section of the theoretical part of examination and solve the 1st task of the practical part of exam

Study subject structure

Part	CP	Hours per Week			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	3.0	2.0	1.0	0.0		*	