

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF MATHEMATICS		
LEVEL OF STUDIES	UNDERGRADUATE PROGRAM		
COURSE CODE		SEMESTER	C
COURSE TITLE	DISCRETE MATHEMATICS		
INSTRUCTOR	Panagiotis Nastou		
INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS	
	4	6	
COURSE TYPE	Special background		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://www.math.aegean.gr/index.php/en/academics/undergraduate-programs		

(2) LEARNING OUTCOMES

Learning outcomes
<p>This course aims at introducing students to the basic theory of counting discrete structures as well as graph theory. The first part of the course covers fundamental issues of set theory, the rule of product and sum, permutations and combinations, discrete probability, the pigeonhole principle and its application, relations and functions. The students learn about equivalence relations and their connection with partitions of a set, partial order relations and topological sorting. In the second part of the course the students are introduced to graph theory. First the fundamental definitions of directed/undirected and weighted graphs and polygraphs, path and circuits and the handshake lemma are given. Then the students are familiarized with basic traversability theory (Euler and Hamilton cycles), conditions sufficient for the existence of Hamiltonian cycles, graph connectivity, trees and rooted trees, spanning trees and algorithms for finding a minimum spanning tree in a graph.</p>
General Competences
Working independently. Team working. Working in an interdisciplinary environment.

(3) SYLLABUS

<p>First part: Counting Theory of Discrete Structures</p> <p>Basics on Set Theory. Mathematical Induction. Principles on Counting the elements of a Set and the Inclusion-Exclusion Principle.</p> <p>Random Experiment, Sample Space, events και probability of an event. Product and Summation rules. Permutations and r-permutations.</p> <p>r-combinations. Permutations of objects of the same type and algebra of combinations. Binomial Theorem. r-combinations with repetition. Balls in the bins distributions.</p> <p>Probability function of a discrete sample space. Conditional Probability and the Bayes Theorem. Expected value and Binomial Distribution.</p> <p>Relations and Functions. The Pigeonhole Principle and its application. Counting functions. Binary</p>

Relations properties. Counting Binary Relations. Composition of Binary relations. Binary Relation Closure. Set partition. Binary Relation Equivalence. Partially and Totally Ordered Relation. Topological Sort Algorithm.

Second Part: Graph Theory.

Undirected Graph, simple graph and polygraph. Vertex degree and the Handshake lemma. Complete Graph. Bipartite Graph. Canonical Graph. Subgraph, complement of a subgraph and spanning subgraph. Directed and Weighted Graph.

Paths and Circuits. Connected graph. Connected Components of a graph. Connectivity and paths. Vertex and Edge Connectivity. Distance between vertices. Vertex Eccentricity. Radius, Diameter and central points of a graph.

Euler circuits and paths. Algorithm for finding an Euler circuit. Hamiltonian circuit and path. The traveling Salesman problem. Isomorphic Graphs. Trees and trees with root. Spanning Trees and Minimum Spanning Trees. Prim και Kruskal Algorithms for finding minimum spanning trees.

TEACHING MATERIAL DISTRIBUTION	The teaching material of the course is uniformly distributed during the semester.
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(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face lectures	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	<ul style="list-style-type: none"> • Use of ICT in teaching • Slides are used during lectures • Communication with students via e-mail. • Uploading slides and course material on moodle system. 	
TEACHING METHODS	<i>Activity</i>	<i>Semester workload</i>
	Lectures	52
	Independent study	98
	Course total (25 per ECTS)	150
COURSE COMMITMENTS	Attending course is not obligatory.	
STUDENT PERFORMANCE EVALUATION	Student's evaluation is done in Greek through a written examination which includes short-answer questions and problem solving. For students with disabilities, evaluation takes place via oral exams.	

(5) ATTACHED BIBLIOGRAPHY

<ol style="list-style-type: none"> 1. Discrete Mathematics and its Applications, Susanna S. Epp, BROOKS COLE ISBN 978-0495391326. 2. Elements of Discrete Mathematics, Liu C.L., McGraw Hill Computer Science Series, ISBN 978-0070381339.
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