

COURSE SYLLABUS STEM Ed Abroad Program

Course Title: Discrete Mathematics for Computer Scientists

Course Semester: Fall

University and Country: Adam Mickiewicz University; Poznan, Poland

Number of ECTS: 6 (lecture)

Course Designations for Transfer Credit: CSC226 (NCSU)

Content: Propositional logic and predicate calculus. Methods of proof. Elementary set theory. Mathematical induction. Recursive definitions and algorithms. Solving recurrences. The analysis of algorithms and asymptotic growth of functions. Elementary combinatorics. Introduction to graph theory. Ordered sets, including posets and equivalence relations. Introduction to formal languages and automata.

Pre-requisites: CSC,CSU Majors and minors;CPE,CPU Majors Propositional logic and the predicate calculus. Logic gates and circuits. Methods of proof. Elementary set theory. Mathematical induction. Recursive definitions and algorithms. Solving recurrences. The analysis of algorithms and asymptotic growth of functions. Elementary combinatorics. Introduction to graph theory. Ordered sets, including posets and equivalence relations. Introduction to formal languages and automata.

Aims: Upon satisfactory completion of this course, you should be able to:

- Understand, within the framework of the propositional calculus, truth tables, logical equivalence and implication, tautologies and contradictions, rules of inference, how to do logical proofs including direct proofs, indirect proofs, and proofs of implications.
- Know and understand logical predicates and the universal and existential quantifiers, and how to use them to represent English statements of quantity. Students will be able to carry out proofs containing quantified axioms.
- Know basic set definitions, be able to prove elementary properties of sets using formal, set theoretic notions, and be acquainted with infinite sets and their properties. Students will understand “diagonalization arguments” as illustrated by the proof of the non-countability of the real numbers and by the “halting problem.”
- Have basic knowledge of functions, 1-1 functions, onto functions, and 1-1 correspondences. Students will be acquainted with sequences and how they are different from sets.
- Understand the concept of Big-O, Big-Omega and Big Theta (order) complexity, and how to solve run-time problems based on these concepts. Students will understand how to analyze simple algorithms with regard to their run-time complexity.
- Have a solid working knowledge of proof by mathematical induction, and will be comfortable with inductive proofs.

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- Understand modular computations, algorithms for computing efficiently with huge numbers, and the theorems that underlie modern cryptography such as Fermat's Little Theorem. Students will understand how RSA encryption works.
- Understand recursive definitions of sets, strings and sequences, and be able to find closed-form solutions to simple recurrence relations, and prove the correctness of such solutions by means of mathematical induction. Students will acquire skill in finding recurrence relations that model a problem and finding recurrence relations based on the closed form of a sequence.
- Understand basic combinatorics, including the rules of product and sum, permutations and combinations with and without "replacement."
- To be conversant both with ordinary numerical matrices and Boolean matrices, and the various operations that apply to them.
- Comprehend the notion of a binary relations, and the accompanying definitions, expressed in logical formalism, of Reflexive, Irreflexive, Symmetric, Antisymmetric, Asymmetric and Transitive. They will also understand significant kinds of binary relations such as Partial Orders and Hasse Diagrams, and Equivalence Relations and Equivalence Classes. Students will know how to represent relations in matrices, thus allowing them to be computationally processed.
- Have knowledge of elementary graph theory, including formal definitions of graphs using logic, types of graphs including simple graphs, directed graphs, multigraphs and pseudographs; isomorphisms of graphs, adjacency matrix representations of graphs, and incidence matrix representations of graphs. Students will further understand the notions of Euler circuits, Euler paths, Hamiltonian circuits, Hamiltonian paths, and how to compute whether such circuits and paths exist within a graph.
- Understand trees as special types of directed graphs and how to prove properties of trees by means of inductive proofs on the heights of trees.

Books: Required:

Discrete Mathematics and its Applications, 7th Edition. Kenneth Rosen, McGraw-Hill, 2011.

Hardcover: ISBN-10: 0-07-338309-0 ISBN: 978-0073383095

Paperback: ISBN-10: 0-07-131710-4 ISBN-13: 978-0-07-131710-8

Optional:

Student Solutions Guide, 7th Edition. Kenneth Rosen, McGraw-Hill, 2011.

ISBN-10: 0077353501

ISBN-13: 978-0077353506

Grading System and Percentage Contribution

The final grade in the course is based on:

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Homework (30%)
 3 Exams (15% each)
 Final Exam (25%)

AMU Grading system and scale

The grading system used at Adam Mickiewicz University, whose name is abbreviated as AMU or UAM, is as follows:

Tests, exams, homework assignments grading scale

5 100%-91%
 4+ 90%-86%
 4 85%-76%
 3+ 75%-71%
 3 70%-60%
 2 59% and less

This translates into the following ECTS (European internationally recognized system) grading scale:

ECTS Grade	AMU grade	Definition
A	5.0	EXCELLENT – outstanding performance with only minor errors
B+	4+ / 4.5	VERY GOOD – above the average standard but with some errors
B	4.0	GOOD – generally sound work with a number of notable errors
C+	3+ / 3.5	SATISFACTORY – fair but with significant shortcomings
C	3.0	SUFFICIENT – performance meets the minimum criteria
F	2.0	FAIL – considerable further work is required

Hours: The schedule below is given for 2 Lecture hours per week (75 min. per lecture), but can be adapted to 3 Lectures per week as required for the Polish system.

Week	Session	Day	Date	Topic
1	1	T	7-Jan	Introduction + (Sets) + [Combinatorics]
1	2	Th	9-Jan	Combinatorics
2	3	T	14-Jan	Combinatorics
2	4	Th	16-Jan	Combinatorics
3	5	T	21-Jan	Combinatorics
3	6	Th	23-Jan	Logic
4	7	T	28-Jan	Logic
4	8	Th	30-Jan	Logic
5	9	T	4-Feb	Test 1 Review
5	10	Th	6-Feb	Test 1
6	11	T	11-Feb	Logic Proofs
6	12	Th	13-Feb	Logic Proofs
7	13	T	18-Feb	Predicate Calculus
7	14	Th	20-Feb	Arithmetic Proofs
8	15	T	25-Feb	Arithmetic Proofs
8	16	Th	27-Feb	Induction

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9	17	T	3-Mar	Induction
9	18	Th	5-Mar	Induction
10	XX	T	10-Mar	Spring Break
10	XX	Th	12-Mar	Spring Break
11	19	T	17-Mar	Test 2 Review 2
11	20	Th	19-Mar	Test 2
12	21	T	24-Mar	Big-O
12	22	Th	26-Mar	Big-O
13	23	T	31-Mar	Recursion
13	24	Th	2-Apr	Recursion
14	25	T	7-Apr	Binary Relations
14	26	Th	9-Apr	Binary Relations
15	27	T	14-Apr	Graph Theory
15	28	Th	16-Apr	Graph Theory