



DEPARTMENT OF MATHEMATICS

MATH 3325-OU1 DISCRETE MATHEMATICS: SEMESTER II, 2017-18

Time: MW 0900AM–10:40AM A-225

Instructor: Philip Pennance

C-118, ext-88264

Email: philip.pennance1@upr.edu

Office hours: MWF 11:00AM-01:00PM.

Description

MATH 3325. Discrete Mathematics *Three credits. Three hours of lecture per week.*
Prerequisite: 3151.

Logic, basic set theory, proof techniques, mathematical induction, relations and functions, combinatorics, probability, graphs and digraphs, elementary number theory.

Course Objectives

After this course the students are expected to:

1. be competent in the methods of mathematical reasoning and proof relating to each part of the syllabus.
2. have developed their skills in thinking logically, formulating precise mathematical arguments, solving problems and presenting solutions in a good mathematical style.
3. have become familiar with the definitions, concepts, results and methods of proof relating to each part of the syllabus;
4. be able to quote the definitions and results, and to reproduce the proofs of some key results.
5. be able to solve problems relating to the material covered. These might be straightforward applications of the definitions and results but might also be problems of a more testing nature.

Syllabus and Approximate Time Distribution¹

1. Elementary set theory and methods of proof. (6 hours)
 - (a) Propositional and predicate logic.
 - (b) Valid and invalid arguments.
 - (c) Direct proofs and counterexamples.
 - (d) Argument by contradiction and contraposition.
 - (e) Argument by dichotomy.
 - (f) Sets and set operations
2. The Natural Numbers. (6 hours)
 - (a) Even and odd integers.
 - (b) Divisibility. Prime and composite numbers.
 - (c) Well ordering property of the natural numbers.
 - (d) Mathematical Induction.
 - (e) The Recursion theorem.
 - (f) The division algorithm.
 - (g) Euclid's algorithm.
 - (h) Greatest common factors and least common multiples. Bézout's identity
3. Relations and functions. (4 hours)
 - (a) The concepts of relation and function.
 - (b) Domain, codomain, image and graph
 - (c) Composition of relations.
 - (d) Inverse relations.
 - (e) Injections, surjections and bijections.
- (f) Inverse functions.
4. Elementary combinatorics (6 hours).
 - (a) The definition of a finite set and its cardinality.
 - (b) The disjoint union of sets and its cardinality.
 - (c) The pigeonhole principle.
 - (d) The inclusion–exclusion principle.
 - (e) Counting of special sets
 - i. Subsets, multisets and partitions of a finite set.
 - ii. Different types of functions.
 - iii. Balls in boxes.
 - iv. Simple graphs, edge unlabelled graphs.
 - (f) Application to Probability.
5. Binary relations and directed graphs (6 hours)
 - (a) Reflexivity, symmetry and transitivity.
 - (b) Pre-order relations
 - (c) Equivalence and order relations.
 - (d) Partially and totally ordered sets.
 - (e) The equivalence relation associated with a pre-order and the corresponding order induced on the set of equivalence classes.
6. Graph Theory. (4 hours)
 - (a) Different types of graphs.
 - (b) Paths and cycles. Connectivity and trees.
 - (c) Isomorphism.

¹All right is reserved to adjust these times as necessary.

Instructional Strategies

Lectures, class discussion, exercises.

Resources

Classroom, internet, handouts.

Evaluation

Grade will be based upon three in class exams (75%) and one take home exam (25%).

Grading Scale

Letter grade (A, B, C, E or F)

Text

Sussana S. Epp, *Discrete Mathematics with Applications*, Fourth edition (2010), Wadsworth Publishing Company, ISBN-10: 0495391328.

Bibliography

1. Peter J. Eccles *Introduction to Mathematical Reasoning*, Cambridge University Press, 1999.
2. Ian Stewart and David Tall, *Foundations of Mathematics*, Oxford University Press, 1986.
3. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, McGraw-Hill.
4. Matousek and Nešetřil, *Invitation to Discrete Mathematics*, Oxford University Press, 1998.
5. Norman L. Biggs, *Discrete Mathematics*, Oxford University Press.
6. Steven Skiena, *Implementing Discrete Mathematics*, Addison Wesley, 1990.
7. Robert F. Lax *Modern Algebra and Discrete Structures*, Harper Collins, 1991.

Academic Honesty

All homework should be done independently –collaboration is not permitted. Cheating and other anti-intellectual behavior may result in an *F*. Please make sure you read, understand and abide by the Academic Integrity Code of the University of Puerto Rico.

Students with Disabilities

If you have a disability for which you may be requesting an accommodation, please contact both your instructor and the office of Vocational Rehabilitation as early as possible in the term. Vocational Rehabilitation will verify your disability and determine reasonable accommodations for this course.