TUFTS UNIVERSITY  
Department of Mathematics

Math 61  
Discrete Mathematics  
Fall 2013

Syllabus

Meeting block: I+ (Mon Wed 3:00 - 4:15 p.m.) in BP-101.
Instructor: Alberto López Martín (alberto.lopez@tufts.edu)
Office hours¹: Mon 1:30 - 3:00 p.m., Wed 1:30 - 3:00 p.m. in BP-106, or by appointment.

Prerequisites: Math 32, Comp 11, or instructor’s consent


Course Website: We will not be using Trunk. All information will be posted on the instructor’s website: http://alopez.math.tufts.edu/fall2013/

Description: Discrete mathematics is not the name of a branch of mathematics; it is the description of several branches that all have a common feature: they deal with objects that can assume only distinct, separated values. The term "discrete mathematics" is therefore used in opposition to "continuous mathematics," which are the branches in math dealing with objects that can vary smoothly (and which includes, for example, Calculus). While discrete objects can often be characterized by integers, continuous objects require real numbers.

For a detailed list of topics covered in this course, go to the last page of this syllabus.

Class attendance: It is highly recommended. We will not be following the book too closely, so during the lectures we may encounter examples and material that are not given or covered anywhere in the book.

Homework: Problem sets will be assigned weekly and homework will usually be collected, using folders handed out during the first lecture, each Monday. The first homework is due on September 16, and it will cover material covered in the first three lectures. Problem sets will be posted on the website above.

It is extremely important that you try and do all exercises. The more practice you get, the less time you will spend setting up problems in quizzes and exams. You are encouraged to collaborate with other students on the homework and to check your solutions for mistakes, as well as to come to office hours for hints and ideas. However, you must submit your own answers showing all of your work.

Quizzes: There will be five (5) quizzes throughout the semester, each of them worth 25 points. At the end of the semester, the lowest score will be dropped and the remaining four (4) will be used to compute Q in the formulas below. The dates for the quizzes will be announced in class.

Exams: There will be two non-cumulative in-class midterm exams
  · the first one on Monday, October 21,
  · the second one on Monday, November 18,

as well as a cumulative final exam
  · on Thursday, December 12, 8:30 - 10:30 a.m.

¹There will be no office hours during the weeks 10/7-10/11 and 10/14-10/18. There will be a review session before the first midterm, on October 20, at a time and place TBA.
Grading: Your score $S$ in the course is the largest of the following two quantities:

$$S_1 = .10H + .10Q + .25M_1 + .20M_2 + .35F$$
$$S_2 = .10H + .10Q + .20M_1 + .15M_2 + .45F$$

where $H$ is your homework score, $Q$ is the sum of all your quiz scores, $M_1$ is your higher midterm score, $M_2$ is your lower midterm score, and $F$ is your score on the final exam.

If you miss a midterm exam for a reason accepted as legitimate by the Department of Mathematics, your course score $S$ would be the largest of these two numbers:

$$S_1 = .10H + .10Q + .20M + .60F,$$
$$S_2 = .10H + .10Q + .15M + .65F$$

This score $S$ will be converted into a letter grade according to the conversion chart given on the department website: http://math.tufts.edu/downloads/Exams&Grading.pdf.

Learning Objectives: The course aims to provide students with a solid conceptual foundation in abstract algebra; the course will be taught in accordance with Learning Objectives 1, 2, 3, and 6 as listed at http://ase.tufts.edu/faculty-committees/assessment/math.htm.

Disability Services: If you are requesting an accommodation due to a documented disability, you must register with the Disability Services Office at the beginning of the semester. To do so, call the Student Services Desk at 617-627-2000 to arrange an appointment with Linda Sullivan, Program Director of Disability Services.
The following is a tentative list of topics. Topics likely to be skipped are those marked with a star (⋆). We might come back to them towards the end of the semester, if we have time.

**PART I**

1. Basics of counting
   1.1 The rules of sum and product
   1.2 Permutations
   1.3 The binomial theorem
   1.4 Combinations with repetition
2. Logic and proofs
3. Basics of set theory
   3.1 Sets and subsets
   3.2 Set operations and laws of set theory
      i. union, intersection, symmetric difference…
      ii. complement of a set
      iii. Venn diagrams
   3.3 Probability
4. Mathematical induction
5. Relations and functions
   5.1 Relations
   5.2 Functions; one-to-one functions
   5.3 Onto functions. (⋆ Stirling numbers of the second kind.)
   5.4 The pigeonhole principle
   5.5 Function composition and inverse functions
6. Recurrence relations
   ⋆7 Generating functions
      7.1 Generating functions and combinatorial problems
      7.2 Generating functions and recurrence relations

**PART II**

8. Graph theory
   8.1 Definitions and examples
   8.2 Subgraphs, complements, and graph isomorphism
   8.3 Vertex degree: Euler trails and circuits
   6.4 Planar graphs
   6.5 Hamilton paths and cycles
   ⋆9. Trees