Combinatorics, 1MA020, Course Plan

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Welcome to Combinatorics 1MA020, I am your course instructor

My name is Xing Shi Cai. You can call me Cai (sounds a bit like Kai).

About combinatorics

Combinatorics is

- a branch of mathematics that mostly deals with counting;
- one of the most fascinating subjects on this planet;
- very concrete and has a wide range of applications;
- also a fun intellectual game to play.

Example 1: Binge TV watching

Season 1 of *The Melancholy of Haruhi Suzumiya* (a Japanese anime series) has 11 episode.

It is about time traveling so you can watch the episodes in any order.

Example 1: Binge TV watching

An anime fan asked the following question

The problem

If you want to see the series in every possible order, what is the minimal number of episodes you have to watch?
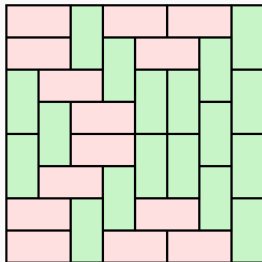
Challenge Whoever can solve this problem automatically get full marks for this course!!

Example 2: Domino tiling

Suppose you want to cover a standard 8-by-8 chessboard entirely with 1-by-2 dominoes that each cover two squares on the board.

The problem

- How many ways are there can you do it?

- What happens if a pair of opposite corners of the board are removed?

About the course

The are going to be twelve lectures, three tutorials, and one quiz.

The lectures will mainly deal with the basic theory.

The tutorials will be devoted to problem solving.

The quiz will be done in class, and graded by your fellow students.

- 1 point for each assignment (3 in total).
- 1 point of the quiz.
- 40 points for the exam.
- You need
  - 18 points for the grade 3,
  - 25 points for the grade 4,
  - 32 points for the grade 5.
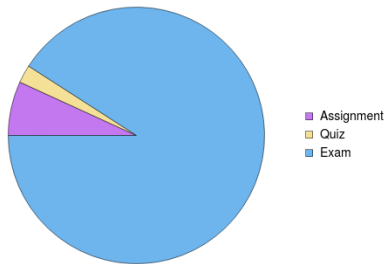
The preliminary schedule

Class	Content	Book Ch.
1	Introduction to Combinatorics	1
2	Strings, Sets, and Binomial Coefficient	2.1–2.3
3	Strings, Sets, and Binomial Coefficient cont.	2.4–2.7
4	Induction	3.1–3.8
5	Tutorial 1	
6	Inclusion-Exclusion	7.1–7.3
7	Generating functions	8.1–8.3
8	Generating functions cont.	8.4–8.6

Class	Content	Book Ch.
9	Tutorial 2	
10	Recurrence Equations	9.1–9.3
12	Recurrence Equations	9.4–9.6
11	In class quiz	
13	Probability	10.1-10.4
14	Probability cont.	10.5-10.6
15	Probability in Combinatorics	11
16	Tutorial 3	

Assignments

There are going to be three assignments.

Each assignment accounts for 1 point in your final grade.

The assignment is graded by completion

- if you have completely finished it – you get one point even if your answers is not entirely correct.
- if you have not completely finished it – you get nothing.

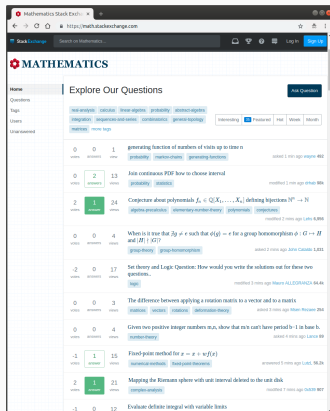There will be some feedback on assignment!

When the assignment is too hard for you

You are encouraged to

- Ask a friend
- Check a book
- Google it
- Post a question at math.stackexchange.com
- Come to the office hour

- Extremely useful. Register today.
- Read the tutorial
  math.stackexchange.com/tour
- Learn to use LaTeX
- Say something about what you think of the question

It's Okay if you are not able to come.

If you come, I will try to make it worth it for you.

Before each lecture, you will receive:

- Slides for the lecture, including
- a list of online resources and recommended exercises for self-study.

No hands-up rule

If you do come to lectures, you do not have to raise your hand to answer questions. Because…

No hands-up rule

If you do come to lectures, you do not have to raise your hand to answer questions. Because we will choose random students to answer questions

You do not have to come.

You can do the quiz at home as a assignment.

But you will be better prepared for the real exam.

And you will learn how you will be graded in exam.

My door is open for you every
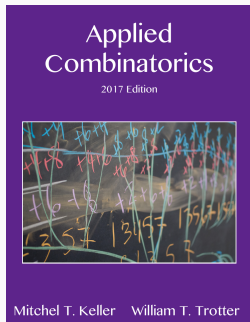Wednesday morning 1030-1200, Jan
23–Mar 20 2019.

Come and talk about anything!

Address: Room ÅNG 74115
Lägerhyddsvägen 1, Hus 7

The textbook

Applied Combinatorics by Mitchel Keller and William Trotter, ~~2016~~ 2017 edition.

Free to download at http://www.rellek.net/appcomb/

Questions?

Appendix

Reference

More about the two problems can be found in two very entertaining articles in Quanta Magazine

- Mystery Math Whiz and Novelist Advance Permutation Problem
- Four Is Not Enough