# Math 43900 Problem Solving
# Fall 2018
# Lecture 9 Combinatorics

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# 1 Problems

## 1.1 Configurations

**Easier**

  1. [Hint: Recursion.]

**Harder**

  1. [Hint: Look at the elements of $X$ in descending order of the number of sets $A_i$ containing them..]

## 1.2 Combinatorial coefficients

**Easier**

  2.

**Harder**

  3. [Hint: Use $\binom{a}{b} + \binom{a}{b+1} = \binom{a+1}{b+1}$..]

## 1.3 Combinatorics and probabilities

**Easier**

  4.

**Harder**

  5.

## 1.4 Extra problems

**Easier**

  6. [Hint: brute force.]

  7.

  8. [Hint: use the pigeonhole principle..]

9.

10. [Hint: use divisibility, some playing around, and induction..]

11. [Hint: pigeonhole..]

12.

13. [Hint: play around with small $n$ and use induction to find a formula for the number of regions for $n+1$ in terms of the number of regions for $n$..]

14.

15.

16.

17. [Hint: Work with the binomial expansion..]

18.

19.

## Harder

20.

21.

22. [Hint: the RHS is the coefficient of $x^n$ in $(x+1)^{2n} = (x+1)^n(x+1)^n$..]

23.

24.

25. [Hint: brute force.]

26. [Hint: Write the determinant as a sum over permutations..]

27.