Summary of Generalized Inclusion/Exclusion

$$|A_1 \cup \cdots \cup A_n| = |A_1| + \cdots + |A_n| - |A_1 \cap A_2| - \cdots + |A_1 \cap A_2 \cap A_3| + \cdots \pm |A_1 \cap A_2 \cap \cdots \cap A_n|$$

	x in k of them
$[-C(n,0)]$	
$C(n,1)$ sets	$C(k,1)$ times
$-C(n,2)$ sets	$-C(k,2)$ times
$+C(n,3)$ sets	$+C(k,3)$
$-C(n,4)$ sets	$-C(k,4)$
$+ \cdots$	$\vdots$
$-$	$\pm C(k,k)$
$\pm C(n,n)$ sets	again, sums to one.

So x in All of A_i is counted once

sums to 1

Permutations w/ replacement

Choose from 30 students to assign 5 tasks w/replacement?

$\longrightarrow 30^5$ ways

Combinations w/ replacement

How many ways can you buy 10 cookies from a shop selling four kinds (CC, SN, OR, PB)?

$C(10,2)$

4^{10} overcounts by counting e.g. CC CC — CC PB 45 times

CC CC — CC PB 10 times

but CC CC CC — CC 1 time

idea change representation to 4-tuple of nonneg. numbers adding to 10.

And use tally marks. 10 tally marks + 3 commas describes each bag.

There are $C(13,3)$ possible bags of 10 cookies from this shop.

$C(n+k-1, n-1) = C(n+k-1, k)$ $\quad n=4$, $k=10$

Permutations with indistinguishable elements

How many different anagrams are there of PURDUE UNIVERSITY ?

Left as exercise