

Discussion 6B Recap

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1 Review

Recall the following notions:

- $n! = \#$ of permutations of n items $= n \times (n - 1) \times \cdots \times 2 \times 1$.
- $\binom{n}{k} = \#$ ways to pick k items from n (w/o order) $= \frac{n!}{k!(n-k)!}$.

2 Balls and Boxes

I have an entire handout for this. Go read that. Afterwards, you should be able to understand the diagram I drew last discussion.

3 Combinatorial Proofs

- “Story-telling” proofs: proving an identity by counting the same thing two different ways.
- Not an algebraic proof, which usually involve expanding and manipulating expressions.
- $\binom{n}{k} = \binom{n}{n-k}$: # of ways to pick a k -person team from n . Either pick the k people on the team or the $n - k$ not on the team.
- When you see binomial coefficients like $\binom{n}{k}$, consider picking people to form teams or committees. If there’s multiple layers, like $\binom{k}{r}$, consider picking leaders of each group.
- If you see 2^n , this always hints to picking all subsets of people. The other side will usually be counting the subsets iterating over size.
- Further exponentials (like 3^n): n boxes with 3 distinct items each, number of subsets of items from the boxes.