

Administrivia

- “Useful links” page has link to Web site with more counting examples.
- Homework 7 due today. Homework 8 on Web; due Monday April 17.

Slide 1

Permutations

- We might want to know how many ways we can choose an ordered sequence of r objects, chosen from n possibilities with no repeats. Call this $P(n, r)$.
Example: How many 7-digit phone numbers have no repeated digits?
- Can we come up with a general formula? (Of course. Let's derive one.)
- Look at some boundary cases — $r = n$, $r = 0$, $r = 1$, etc. (We'll need to agree that $0! = 1$.)

Slide 2

Combinations

- Or we might want to know how many ways we can choose an *unordered* collection of r objects, chosen from n possibilities with no repeats. Call this $C(n, r)$.

Example: How many ways can we draw 5 cards from a deck of 52?

Slide 3

- Can we come up with a general formula? (Of course. Let's derive one.)
- Again look at some boundary cases — $r = n$, $r = 1$, $r = 0$.
- (Another common notation for this is $\binom{n}{r}$ (“ n choose r ”).)

Permutations Versus Combinations

- In general: If order matters, it's a permutation; if order doesn't matter, it's a combination.
- (Contrast “how many phone numbers with no repeated digits” (order matters) with “how many 5-card hands?” (order doesn't matter).)

Slide 4

Slide 5

Potential Pitfall — Counting Things Twice

- A problem is that some proposed solutions sound reasonable but actually manage to count some things twice, or don't count some things at all.
- Example: example 55 part (d).

Slide 6

Permutations and Combinations — Eliminating Duplicates

- In general it can be interesting to try to figure out how to “eliminate duplicates” — i.e., account for the fact that one way of counting things produces a lot of duplicate results.
- Example: How many ways can we rearrange the letters in the word “voodoo”?

Permutations and Combinations With Repetitions

Slide 7

- Definitions of $P(n, r)$ and $C(n, r)$ specified “without repeats”. What if we want to allow repeats?
- Permutations: How many ways can we choose an ordered sequence of r things from n possibilities, if we allow repeats? (Not too tough, right?)
- Combinations: How many ways can we choose an unordered collection of r things from n possibilities, if we allow repeats? This is trickier. We’ll use a clever idea from example 58 (next time).

Minute Essay

Slide 8

- None — quiz.