Pause

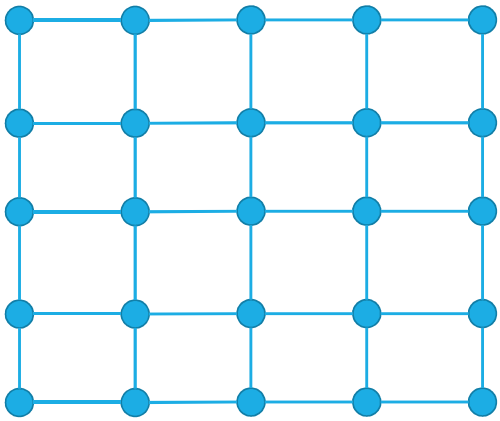
Questions in combinatorics and probability are often dense. A single word can totally change the answer. Does order matter or not? Are repeats allowed or not? What makes two things "count the same" or "count as different"?

Let's look for some keywords

How many length 3 sequences are there consisting of distinct elements of $\{1,2,3\}$.

> **Sequences** implies that order matters – $(1,2,3)$ and $(2,1,3)$ are different.
> **Distinct** implies that you can't repeat elements $(1,2,1)$ doesn't count.
>
> $\{1,2,3\}$ is our "universe" – our set of allowed elements.

Path Counting



We're in the lower-left corner, and want to get to the upper-right corner.

We're only going to go right and up.

How many different paths are there?

$A. 2^8$
$B. P(8,4)$
$C. \binom{8}{4}$
D. Something else

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Overcounting

How many anagrams are there of SEATTLE
(an anagram is a rearrangement of letters).

It's not 7! That counts SEATTLE and SEATTLE as different things!
I swapped the Es (or maybe the Ts)

One More Counting Technique

Complementary Counting
Count the complement of the set you're interested in.

How many length 5 strings over $\{a, b, c, \ldots, z\}$ are there with **at least** 1 'a'
Let A be the set of strings we're interested in, $\mathcal{U}$ be all length 5 strings
$|A| = \left|\mathcal{U} \setminus \bar{A}\right| = |\mathcal{U}| - \left|\bar{A}\right| = 26^5 - 25^5$