

Counting

Week 3 Fall 15
FND Review
Written Notes

Adding vs Multiplying

Total # people in room =
women + # men

Anytime $A \cap B = \emptyset$

$$|A \cup B| = |A| + |B|$$

Go wrong in 2 ways

(a) miss some item

(b) count an item more than once.

mult $|A \times B| = |A| \times |B|$

entree \ sides	cinnas non	frozen behe blast		
taco				
burrito		(burrito, sushie)		
me pizza				
gordito				
cunchuap				

Subtracting Rule

Sometimes it's easier to subtract out of the whole, the items you don't want to count!

$$2^{10} - \binom{10}{0} - \binom{10}{1}$$
$$= 2^{10} - 1 - 10$$

$$= 1024 - 11$$

$$= 1013$$

$$\text{Perm } n \text{ items} = n!$$

$$a_1, a_2, \dots = \frac{n!}{a_1! a_2! \dots a_k!}$$

$$\text{Combo} = \binom{n}{k} = \frac{n!}{k!(n-k)!}$$

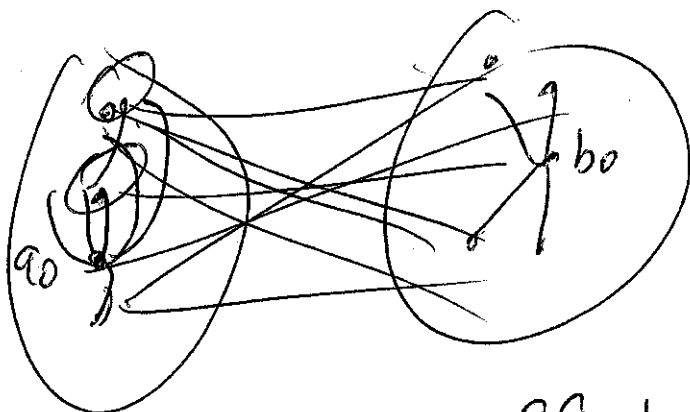
Combos with repetition

buying n items and choosing from k distinct types of items (with no restrictions) we can do this in

$$\binom{n+k-1}{n} = \binom{n+k-1}{k-1}$$

100

900



$$100 \times 900 + 99 + 899$$

$$\begin{array}{r} 90000 \\ 1000 \\ - 2 \\ \hline 90998 \end{array}$$

0000000 group 0

00000000
00000001

0000001 group 1

00000010
00000011

1111111 group 127

11111110
11111111

If I try to pick 129 things from 128 groups, I am forced to pick at least 2 items from some group.

Pigeonhole Principle

$\rightarrow$ ABC, D, E, F
 $\rightarrow$ ACB
 $\rightarrow$ BAC
 $\rightarrow$ BCA
 $\rightarrow$ CAB
 $\rightarrow$ CBA

4!

6! -

$6 \times 4!$

$$x_1 + x_2 + x_3 + x_4 + x_5 = 15$$

$$0 \leq x_i \leq 15$$

$$\binom{19}{4} = \binom{19}{15}$$

diff ~~sols~~ int sols to
this equation

~~1~~ ~~2~~ ~~3~~ ~~4~~ ~~5~~ || ~~6~~ ~~7~~ | ~~8~~ ~~9~~ | ~~10~~ ~~11~~ ~~12~~ ~~13~~ ~~14~~ ~~15~~

$$5 + 0 + 2 + 4 + 4 = 15$$

$$|A \cup B| = |A| + |B| - |A \cap B|$$

bad $6!$ } Some
fech $5!$ } overcounting

How many times do both bad and fech appear?

bad, fech, g $3!$

$$\# \text{ times bad OR fech appears} = 6! + 5! - 3!$$

$$\# \text{ orders w/o either} = 8! - (6! + 5! - 3!)$$

$$= 8! - 6! - 5! + 3!$$