Common Counting: n= 20, k=7, 3i =0

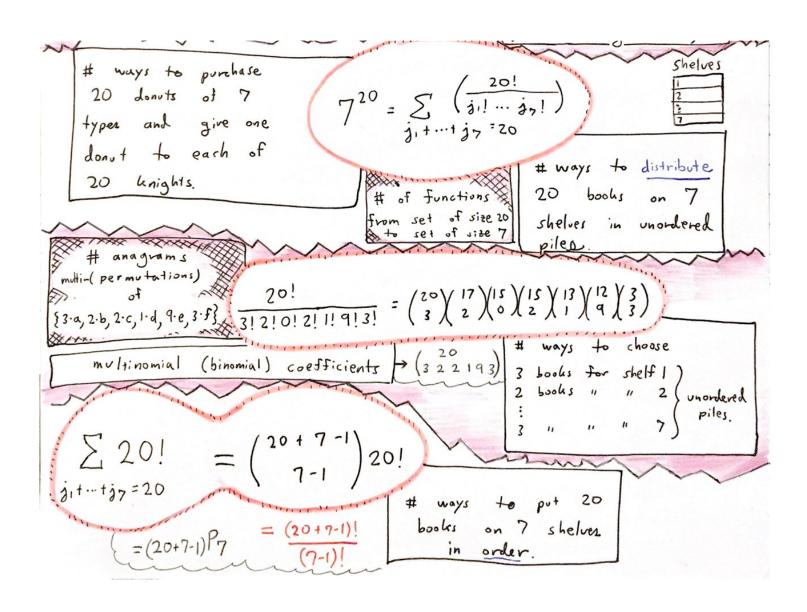
# ways to purchase ) we count the 20 donots of .7 | the resulting bags of donots.

# multi-subsets
(multicombinations)
of size 20 from
{\overline{0}\cdot\0.7}

# ways to distribute 20 identical donuts to 7 knights.

# Non-negative integer solutions to  $x_1 + \cdots + x_7 = 20$ .

the numbers of books
on 7 shelves, 20 total
books (without choosing
which books go where.)



Common Counting: n= 20, k=7, 3i 30 # ways to distribute # multi-subsets # ways to purchase) we count (multicombinations) 20 identical the 20 donuts of .7 of size 20 from resulting donuts to 7 knights. different types. {o.1, o.2, ..., o.7} loags of donuts.  $\binom{20+7-1}{7-1} = \sum_{j_1+\dots+j_7=20}^{1}$ =  $\binom{7}{20}$  =  $\binom{20+7-1}{20}$ # Non-negative integer # ways to plan solutions to x, + ... + x7 = 20. the numbers of books on 7 shelves, 20 total books (without choosing which books go where.) Shelves # ways to purchase  $7^{20} = \sum_{j_1 + \dots + j_7 = 20} \frac{20!}{j_1! \dots j_7!}$ 20 Lonuts of types and give one donut to each of # ways to distribute # of functions 20 knights. 20 books on 7 from set of size 20 shelves in unordered set of size 7 # anagrams multi-(permutations)  $\frac{20!}{\{3 \cdot a, 2 \cdot b, 2 \cdot c, 1 \cdot d, 9 \cdot e, 3 \cdot f\}} = \frac{20!}{3! \ 2! \ 0! \ 2! \ 1! \ 9! \ 3!} = \left(\frac{20}{3}\right) \left(\frac{17}{2}\right) \left(\frac{15}{6}\right) \left(\frac{13}{4}\right) \left(\frac{12}{3}\right)$ # ways to choose multinomial (binomial) coefficients > (322193) 3 Looks for shelf 1) 2 ( unordered piles.  $=\binom{20+7-1}{7-1}20!$ jit ... t j7 = 20 ways to put

on 7 shelver

order.

books

= (20+7-1)!

= (20+7-1) P7