Math 200]. Lecture 14. Midtern 2 (Ch1-3): Friday, Feb 25. 02.16.2022.

Last time: nutisets

· multisets formed using elts from , the bars and -stars method

Today: - more problems

- · another problem related to mutiset: the word problem
- · Summary of types of country problems

1. Examples for bon-and-stars Warmup: , How many multisets of size 4 can be made from { a,b, c,de,f}? (es. x | x | x | | c > a b c c ) Answer! (4 + (6-1)) . 3.8.4 We have so red balls. so blue ball, so green, so white. How many sets of 15 balls can we form out of these so balls?

Answer: (15+4-1) ) ditterence:

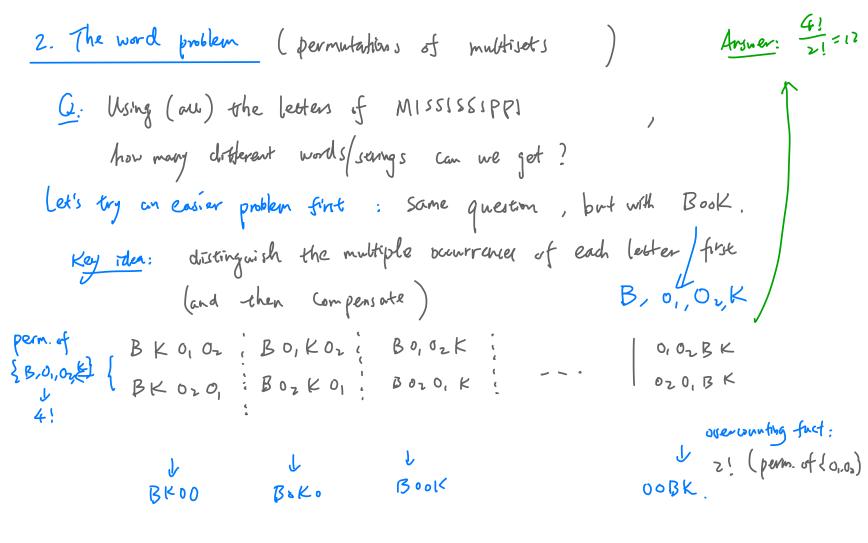
· 3.8-6. 20 red, 20 blue. 20 green, I whote, I black.

I in the second problem the How many sets of zo balls can we form? number of time In light of the limit on it of white and black balls, white and black we use the addition principle and discuss cours: can be used is no black, no white: (3-1); use the black but no white:

Special the other 19 limited.

Another warm-up:  $= \left( \begin{array}{c} \frac{1}{4} \end{array} \right) + \left$ Ex: draw" the solus of 0 \ x \ y \ \ 3. A different problem: 3.21. What's (# int. tuples (w, x, y. z) s-l, 0 < w < x < y < 7 < 10)? Note that such emples are in bijection with stars- and-bars configurations With 10 stars and 4 bars viz the thoology (for the previous problem we had 3 b ans!) -> (w=(4x before the 1st bar), x= #(x's before the >nd bar), stan-and-bars-graph

y=..., ==..) So the desired number is (10+4).



Another example: BANANA. If we distinguished the A's the sames formed out of (B, A, N, Az, Nz, Az) are just permutations of these 6 letters, of which there are 6!

But each string with such distinction corresponds to 31.2! Strings formed

from [B, A, N,A, N, A]. So BAINIAZNIAZ the of spellings of the letter of BANANA = 6:

3! 2!

Point: If A is a multiset with n elts, where the ebt

penutations of A (spellings using all the ests of A)

have multiplicities Pi, Pro -- PK. Then the number of

7. Pr. Pr. .

BA, NYAZNI AZ BAINIAZNZAZ

BAINZAZNZAZ

BA3N2A2NIA1

MISSISSIPPI: 11!

Next time:

Summary of counting problem types

3. A summary We have dealt with counting problems of several types:

(1) Permutation of a set: Consider a set X with N etts

(2) Combination / Subset:

(3) Permutation of multiset:

(4) Multiset Combination: