CY R2/4/21

DRAW 3 COINS W/O REPLACEMENT

W/O REPLACEMENT

3 QUARTERS + 2 DIMES

DRAWING 3 QUARTERS NOT POSSIBLE.

WITH REPLACEMENT, POSSIBLE.

DIVIDE 12 STUDENTS INTO 2 GROUPS OF 6.
ONLY GROUP MEMBERSHIP MATTERS, NOT ORDER DRAWN.

12 WAYS TO PICK 1ST
11 ... 2ND
10 3
9 4
8 5
7 6TH

12 · 11 · 10 · 9 · 8 · 7

THAT COUNTED DIFFERENT ORDERS OF SAME SET. MUST CORRECT.

DO A SIMPLER CASE

$N=4$ STUDENTS. A, B, C, D

$K=2$ IN 1ST GROUP

AB
AC
AD
BA
BC
BD
CA
CB
CD

$4 \cdot 3 = 12$

BUT EACH GROUP IS LISTED TWICE

AB, BA

DIVIDE BY 2

RESULT: $\frac{12}{2} = 6$

AB, AC, AD, BC, BD, CD.

$$\binom{4}{2} = \frac{4!}{2!2!} = \frac{24}{2 \cdot 2} = 6$$

BIG CASE $12 \cdot 11 \cdots 7 = \frac{12!}{6!}$

THAT PICKED EACH GROUP

$k!$ WAYS.

FINAL ANSWER IS $\frac{12!}{6!6!} = \frac{N!}{k!(N-k)!}$

$$= \binom{N}{k}$$

"N CHOOSE k"

PROB 2B.

$$\binom{88}{6}\binom{82}{6}\binom{76}{6}\binom{70}{6}$$

$$= \frac{88!}{6!6!6!6!}$$

2c PICK 1ST CARD.
51 LEFT.
2ND HAS TO BE FROM SAME SUIT: 12
3 11
4 10
5 . . . 9

#WAYS $= \frac{12!}{8!}$ (ORDER MATTERS)

ORDER DOESN'T MATTER: $\frac{12!}{8!5!}$ WAYS.

5

TO CALC PROBABILITY,

USE ORDERED ANSWER

① # HANDS $\frac{12!}{8!}$

HANDS NOT REQ'D TO BE IN SAME SUIT ② $\frac{52!}{47!}$

$$\text{PROB} = \frac{①}{②} = \frac{12! \, 47!}{8! \, 52!}$$

THAT'S $\frac{\text{EQN } ①}{\text{EQN } ②}$ NOT ONE HALF

WAYS TO PICK 5 GOOD WIDS.

(100 WIDS, 10 BAD)

$90 \cdot 89 \cdot 88 \cdot 87 \cdot 86 = \frac{100!}{95!} \quad \frac{90!}{85!}$

WAYS TO PICK

100 WIDGETS $\frac{100!}{95!}$

PROB THAT ALL 5 GOOD $= \frac{90!}{85!} \cdot \frac{95!}{100!}$

PICK EXACTLY 1 BAD WID?

EASY NOT FALSE: DO 5 CASES

BAD WID IS FIRST : $10 \cdot 90 \cdot 89 \cdot 88 \cdot 87$

OR 2nd $90 \cdot 10 \cdot 89 \cdot 88 \cdot 87$

3rd .

4th .

5th .

WAYS TO PICK EXACTLY 1 BAD WID

$$\frac{5 \times 10 \times 86!}{5!}$$

REAL WORLD PROBLEM:

YOU DO NOT KNOW # BAD WIDS.

YOU PICK 5, SEE 0 BAD (1 BD)

WHAT DOES THAT TELL YOU?

APPROVAL VOTING — N CANDIDATES

2^N WAYS TO MARK BALLOT

PREFERENTIAL (RANKED)

AB

N CANDIDATES

YOU VOTE FOR K

$\binom{N}{K} K!$

ORDER MATTERS $\frac{N!}{(N-K)!}$

SUM OVER K

$$\sum_{K=0}^{N} \frac{N!}{(N-K)!}$$

NOTE $= \sum_{K=0}^{N} \frac{N!}{K!} = N! \sum_{K=0}^{N} \frac{1}{K!}$