

COT 3100 10/29/24 10³⁰am

- (1) Post an update about course grades tonight.
— POST FORMULA (plus raw numbers
not percentages)
A line, B line, C line

- (2) Sample Project
— So you can see my expectations
C / Python
9 10³⁰

- (3) Combinations w/ Repetition

How many permutations are there of the letters
in ABRACADABRA?

5 As, 2 Bs, 2 Rs, 1 C, 1 D $\rightarrow \frac{11!}{5!2!2!1!1!}$

another way

11 slots choose 5 A
6 slots choose 2 B
4 slots choose 2 R
 $\binom{11}{5} \times \binom{6}{2} \times \binom{4}{2} \times \binom{2}{1} \times \binom{1}{1} \Rightarrow$ for C only

B A A C R A B D A R A
2 slots choose 1 C
1 slots choose 1 D

Program

Write a program reads in strings of uppercase letters, and for each calculate # perms of letters MOD $10^9 + 7$.

Input (Std.in)

n // int n , # cases

ABRACADABRA

MISSISSIPPI

DOCCAM

$\vdots$

Output

1 int per line ans to each problem

$$\binom{11}{5} \binom{6}{2} \binom{4}{2} \binom{2}{1} \binom{1}{1}$$

cur $\boxed{11}$ 6

f $\boxed{5}$

$$\binom{cur}{f}, \quad cur -= f$$

Combinations w/ Repetition

Taco Bell :
 tacos
 chicken tacos
 nachos
 burrito
 7-layer burrito
 mex pizza
 20 items total

$t + c + n + b + s + m = 20$
 Count the # of non-neg int sol's to this eqn.

(15, 1, 1, 1, 1, 1)

* * * * * | * * * * * | * * * * * | * * * * * | * * * * *

* * * | | * * | * * * * | * | * * * * * * * * *
 3 0 2 4 1 10
 t c n b s m

n items total

r unique options $\rightarrow$ r-1 bars

$$\frac{25!}{20!5!} = \binom{25}{5} = \binom{25}{20}$$

$$\frac{(n+r-1)!}{n!(r-1)!} = \binom{n+r-1}{n} = \binom{n+r-1}{r-1}$$

persons
 n bars
 r-1 stars

choose n out of n+r-1 for stars

choose r-1 slots bar

a) Must have at least 3 mexican pizzas
 $t + c + n + b + s + m = 20$

buy 3 mex pizzas $\Rightarrow$

$$t + c + n + b + s + m = 17 \quad \begin{matrix} n=17 \\ r=6 \end{matrix}$$

$$\binom{17+5}{5} = \binom{17+5}{17} = \frac{22!}{17!5!}$$

b) Store only has 5 mexican pizzas left $\ddot{\smile}$

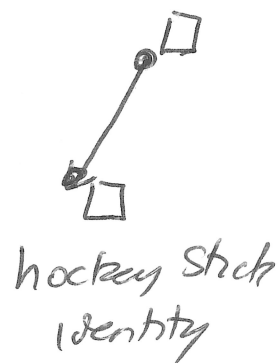
$\rightarrow$ ALL $\rightarrow$ COMBOS w/ 6 or more

$$\rightarrow \binom{25}{5} - \binom{19}{5} \quad \begin{matrix} \text{by 6 Mex P} \\ t + c + n + b + s + m = 14 \end{matrix} \quad \begin{matrix} n=14 \\ r=6 \end{matrix}$$

Alternative Slower route

$$\binom{24}{4} + \binom{23}{4} + \binom{22}{4} + \binom{21}{4} + \binom{20}{4}$$

$m=0 \quad m=1 \quad m=2 \quad m=3 \quad m=4$



c) $m \leq 5$ and $t \leq 3$

$$t + c + n + b + s + m = 20$$

$$\binom{25}{5} - \binom{19}{5} - \binom{21}{5} + \binom{15}{5} \leftarrow$$

$\text{All } m \geq 6 \quad t \geq 4$
 $\quad \quad \quad m \geq 6 \text{ and } t \geq 4$

$$t' + c + n + b + s + m' = 10 \quad \begin{matrix} n=10 \\ r=6 \end{matrix}$$

$$\binom{25}{5} - \left[\binom{19}{5} + \binom{21}{5} - \binom{15}{5} \right]$$

all combos w
 $m \geq 6$ OR $t \geq 4$

d) $\rightarrow (3, 1, 2, 0, 1, 2)$

$$t + c + n + b + s + m \leq 20$$

all in stock!
 # sols

$\rightarrow$ Slack Variable
 leftover

$$= \# \text{ sols } t + c + n + b + s + m + L = 20$$

$n=20$
 $r=7$

$\rightarrow (3, 1, 2, 0, 1, 2, 11)$
 $\boxed{\binom{26}{6}}$

$$(0, 2, 5, 12, 0, 0, 1) \leftrightarrow (0, 2, 5, 12, 0, 0)$$