Pen 1 | Pen 2

---

$S$, $|S| = n$

$|S \times S| = n \times n = n^2$

$|S^k| = |\underbrace{S \times S \times \cdots \times S}_{k \text{ times}}| = \underbrace{n \times n \times \cdots \times n}_{k \text{ times}} = n^k$

(1st op, nor, ... n opt)

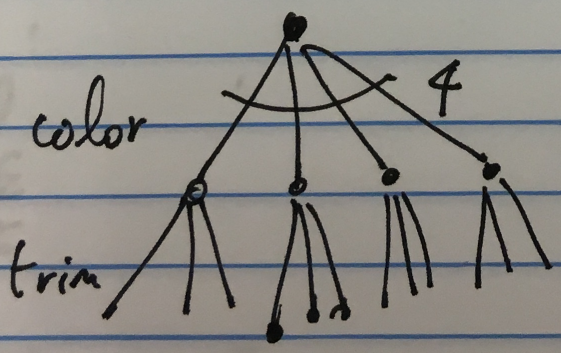
X ——————— X

Car: 4 choices for color

× 3 choices for trim

= 12 choices overall.

Product rule



How many subsets $S \subseteq [n] = \{1, 2, \ldots, n\}$?

$v \in \{0,1\}^n$

# sets $= 2 \times 2 \times \cdots \times 2 = 2^n = |2^{[n]}|$

($n$ times)

$\downarrow$

S: 0 1 0 1 1 0 0 1 1 0 $\in$

4 sections - can have multiple TAs $> 0$
6 TAs

How many assignments s.t. every section gets $\geq 1$ TA?

sections: [4]

A: set of sections taught by Kaitlyn
B: " " " Alex
C: " " " Joshua
D
E
F

WRONG

$2^4 \times 2^4 \times \cdots \times 2^4 = (2^4)^6 = 2^{24}$.

↓ opt for A ↓ opt for B

set of TAs teaching 1st section

| | ↓ | | | |
|---|---|---|---|---|
| A : | 0 | 0 | 1 | 0 |
| B : | 1 | 0 | 1 | 0 |
| C : | 0 | 1 | 0 | 1 |
| D : | 1 | 1 | 1 | 1 |
| E : | 0 | 0 | 0 | 0 |
| F | 1 | 1 | 0 | 1 |

$S_1, S_2, S_3, S_4$ : set of TA's teaching each section

# choices for $S_1$ = $2^6 - 1$ → not allowed $\phi$.

# of subsets of [6]

⋮

# choices for $S_4$ = $2^6 - 1$

Total # choices = $(2^6-1) \cdot (2^6-1) \cdot (2^6-1) \cdot (2^6-1)$

= 15,752,961

C : 0 1 0 1

B : 1 0 1 0

A : 0 0 1 0 ~~1 0~~

↑

5 books.
distribute to
3 children

How many ways?

A : set of books of child 1

[5] ⊇ B :

C :

WRONG

$2^5$
$\times 2^5 = 2^{15}$
$\times 2^5$

↓ ↓ ↓ ↓ ↓

A : 0 1 1 0 0

B : 1 1 0 0 1

C : 0 0 1 1 1

$3 \times 3 \times 3 \times 3 \times 3 = 3^5$ ways.

How many rearrangements of

GRAPEFRUIT ?

$10 \times 9 \times 8 \times \cdots \times 1 = 10!$

GRAPEFRUIT ?

$10!$

GRRAPEFUIT
GRRAPEFUIT

GRAPEFRUIT

$$\frac{10!}{2!}$$

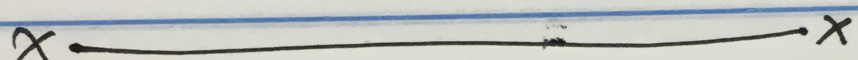
CAAASTLE

$$\frac{8!}{3!}$$

5

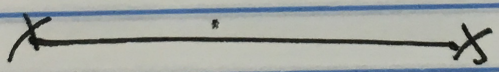
PPFFFLENN

$$\frac{9!}{2! \cdot 3! \cdot 2!}$$



$P(n,k)$ : # of ways to pick a sequence of length $k$ with distinct elements from $n$ things

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



# 5 letter words with distinct letters

$$26 \times 25 \times 24 \times 23 \times 22$$

$$//$$

$$\frac{26!}{21!}$$

ACDEL, . . . — . . . .