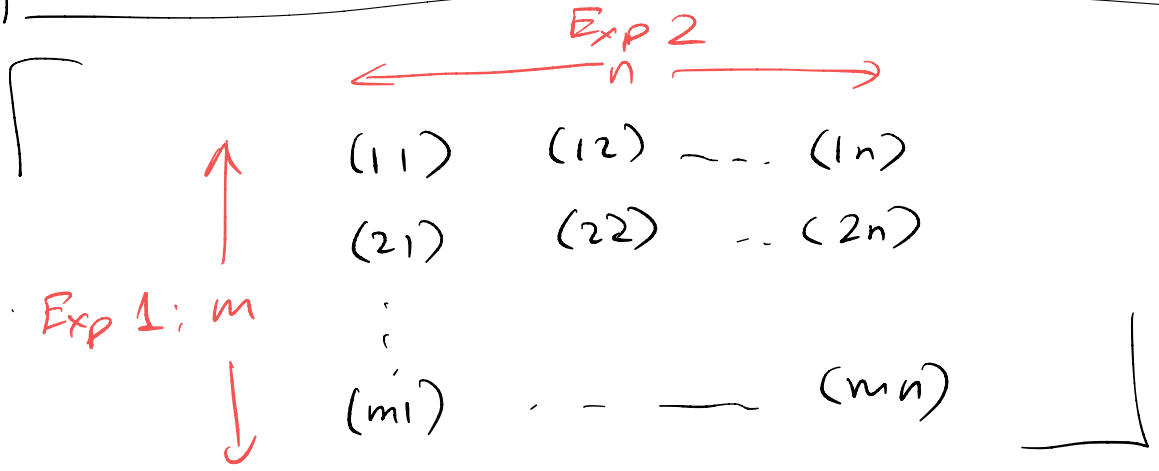
Ex ∃ 3 diff. flights SD → LA
∃ 4 diff. flights LA → SF
} ⇒ ∃ 3·4 = 12 diff. itineraries. SD → SF

⇒ **Multiplication Principle**

Suppose 2 experiments are performed,
exp. 1 can result in ∀ of m possible outcomes
exp. 2 ——— n
⇒ together, there are mn poss. outcomes of (exp. 1, exp. 2)



Generalized MP: $n_1 n_2 \cdots n_k$

Ex # 4-letter words (with or without meaning) e.g. "TINT"

$= \underbrace{26 \cdots 26}_{4} = 26^4 = 456,976$

Ex # 4-letter words with all different letters e.g. "MINT"

$= 26 \cdot 25 \cdot 24 \cdot 23 = 358,800$

Ex (a) Flip a coin 5 times. e.g. HTTHT

possible outcomes $= \underbrace{2 \cdots 2}_{5} = 2^5 = 32$

(b) Toss a die 5 times.

possible outcomes $= \underbrace{6 \cdots 6}_{5} = 6^5 = 7,776$

1.3. Permutations

Question: In how many ways can n people form a line?

6 am DMV ..... (or a passport control line @ airport)

Ans: $n(n-1)(n-2) \cdots 2 \cdot 1 = \boxed{n!}$

choose 1'st — choose 2nd — choose last

Ex How many diff. words can be made of letters U, C, I?

Ans: $3! = 3 \cdot 2 \cdot 1 = 6$. (UCI, UIC, IUC, ICU, CUI, CIU)

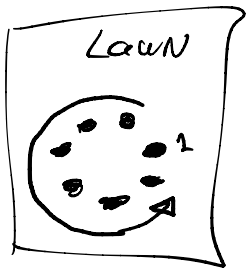
Def A permutation of n different objects is any ordered arrangement of them.

There are $n!$ permutations. CONVENTION: $0! = 1$

Ex # ways to arrange n people in a line so that Jessica is always in front of Yuki?

$\frac{n!}{2}$, By symmetry

Ex # ways to sit n people in a circle



$(n-1)!$: sit Person 1 @ place; let n-1 other people form a "line" counterclockwise of Person 1