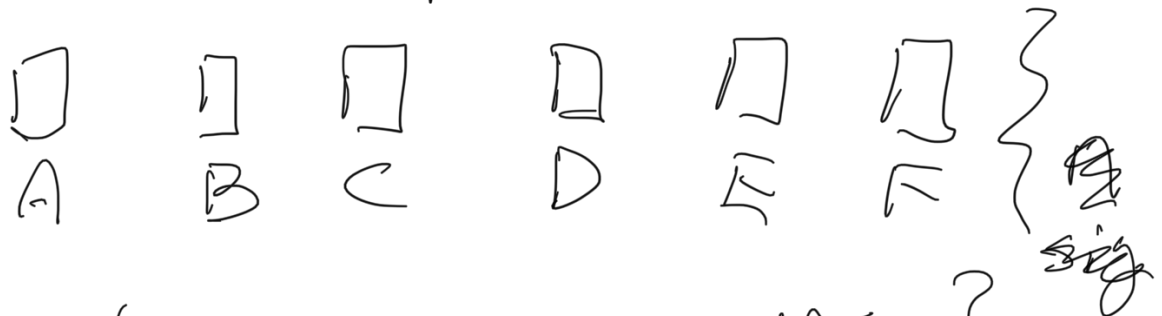


# Counting



How many pairs?  
n things

AB, AC, AD, AE  
BC, BD, ...  
2 things

(~~6~~, ~~6~~) (A, A)

$6 \cdot 5$   

---

2

A, B

B, A

or

$$C_{n,m} = \frac{n \cdot (n-1) \cdot (n-2) \cdot \dots}{m!}$$

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

$\rightarrow m$   
 $\downarrow n$

1	2	3	4	5	6
1	3	6	10	15	20
1	4	10	20	30	35
1	5	15	30	45	56
1	6	15	20	15	6
1	7	21	35	35	21
1	8	28	56	70	56
1	9	36	84	105	84
1	10	45	120	168	120

Pascal's Triangle

$$(x+y)^n$$

$$(x+y)^4 = 1x^4 + 4x^3y + 6x^2y^2$$

---

pairs  $\frac{n \cdot (n-1)}{2}$

$$\frac{n^2 - n}{2}$$

2111 ... 2

$$O(n^2)$$

n things

all permutations

1 2 3 4

$$4 \cdot 3 \cdot 2 \cdot 1 = n!$$

1 2 3 4

24 way

1 3 2 4

2 4 3 2

$$4!$$

!  $O(n!)$  "bad"

n choices

$n = 1 \quad \sigma_1$

0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
	:	

$n = 2 \quad \sigma_1 \sigma_2$

0 1

1 0

( )

$n = 3$

8  
1 2 1 }  $2^n$

---

8 bits      byte  
0000      0000  
1111      1111  
└───┘      └───┘  
16          16

$256$   
8  
2