





pick one card from deck of 54 : 54

chance/probability/likelihood we pick the 3♣ : $\frac{1}{54}$
we pick any 3 : $\frac{4}{54}$

like
possible

and *
or +

pick a letter: 26

pick a letter or a digit : 36
 $26 + 10$

pick a letter and a digit : 260
 $26 * 10$

how many 6-character identifiers are there?

L-L32-
Aa+=Q7

+ 52 letter | left digit) 63
+ 1 or - |
53

* $63 \cdot 63 \cdot 63 \cdot 63 \cdot 63 = 52$ billion and more

Permutation - reordering
mutate

(~~1~~, ~~2~~, 3, ~~4~~, ~~5~~)

(4, 1, 2, 5, 3)

$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \rightarrow$

$5!$ - perm of 5 value

[1, 3, 7]

[1, 7, 3]

[3, 1, 7]

[3, 7, 1]

[7, 1, 3]

[7, 3, 1]

$$(2, 2, 3, 3, 3)$$

$$\frac{5! = 120}{2! \cdot 3!} = \text{not change} = \frac{120}{2 \cdot 6} = 10$$

$$(3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5)$$

$$\frac{11!}{2! \cdot 2! \cdot 3!}$$

choose 2 places for the 2s from 5 available

$$\binom{5}{2} - 5 \text{ spots}$$

$$\binom{2}{2} - \text{choose 2}$$

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

$$\binom{5}{2} = \frac{5!}{2! 3!}$$

$$\frac{5 \cdot 4}{2!} = \frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{(2 \cdot 1) (3 \cdot 2 \cdot 1)}$$

Set of m things

of n -element subsets

$$= \binom{m}{n}$$

80 students

team of 4

$$\binom{80}{4}$$

$$= \frac{80!}{4! 76!}$$

$$= \frac{80 \cdot 79 \cdot 78 \cdot 77}{4 \cdot 3 \cdot 2 \cdot 1}$$

$$10 + 10 + 26 + 26 + 11 + 11$$

94^{12} 12 char 1 upper 1 num 1 special

passphrase

long - 7 words - from a 1000-word string

$$\begin{array}{r} 993 \\ 994 \leftarrow \\ \hline 1000! \\ \hline 993! \end{array}$$

7 word at random
w/o duplicates

$$\frac{1000 \cdot 1000 \cdot \dots \cdot 1000}{1000^7}$$

96
12 chn

at least

10
1 num

$$\binom{12}{1} \cdot 10 \cdot$$

$$96^{12} - 86^{12}$$

roll 3 6-sided dice

add results

prob of roll 8

1st die

1 · 6

2 · 5

3 · 4

4 · 3

5 · 2

6 · 1

1+1+6

1+2+5

1+3+4

2+2+4

2+3+3

6³

$$\frac{3!}{2!} + 3! \times 3! \times \frac{3!}{2!} \times \frac{3!}{2!}$$