1 2 3 4 5 6 7 8 9 A

$$\frac{10!}{3!\,7!} = \binom{10}{3}$$

len-3 Sub seq

123

149

35A

~~43A~~

~~112~~

⋮

len-3 subsi.

123
234
345
456
567
678
789
89A
done!

$$\frac{10 \cdot 9 \cdot 8}{3 \cdot 2} \qquad \frac{5 \cdot 3 \cdot 8}{1}$$

120

(100)(101) → 101000

Combination

Selection, part of

Permutation

reorder

$x!$ = permutations of x values

$\frac{x!}{y!}$ = perm of x values where y are identical

$\frac{x!}{y!(x-y)!} = \binom{x}{y}$

x^2 x^{100} 2^x 100^x $x!$ x^x

exponential

$x!$

x^2

x^{100}

2^x

x^x

100^x

$\binom{x}{s} \cdot x^s \cdot \frac{x!}{2^x}$

I pick s (sew set) of x values

with repeats $= x^s$

with or repeats $= \frac{x!}{s!(x-s)!}$

↑ only set

1 soul mate

$\frac{1}{7 \text{ billion}}$

$\binom{16{,}000}{2}$

$\frac{7{,}000{,}000{,}000}{2s}$

128 million

pairs $= \binom{7 \text{ billion}}{2} =$ 25 years

Speed Daily

soul mates = 3.5 billion

$\frac{7b-1}{7b}$

$$\sum_{i=0}^{n} i = \frac{n(n+1)}{2}$$

$$S = 1 + x + x^2 + x^3 + x^4 + \dots$$

$$xS = \quad x + x^2 + x^3 + x^4 + \dots$$

$$S = \sum_{i=0}^{\infty} x^i$$

$$S - xS = 1$$

$$S(1-x) = 1$$

$$S = \frac{1}{1-x}$$

Job

day 1: 100

day n: (day n-1) $\frac{1}{2}$

$$\sum_{d=1}^{\infty} 100 \left(\frac{1}{2}\right)^{d-1}$$

$$= 100 \sum_{d=0}^{\infty} \left(\frac{1}{2}\right)^{d} = 100 \frac{1}{1-\frac{1}{2}} = \$200$$