$S = \{a, b, c, d\}$

2 - perm. of S

$4 \cdot 3$

ab ca
ac cb
ad cd
ba da
bc db
bd dc

Subsets of size 2

2-combinations

$\{a,b\}$ $\{c,d\}$
$\{a,c\}$
$\{a,d\}$
$\{b,c\}$
$\{b,d\}$

Let n and r be non-neg ints w/ $r \leq n$. An r-combination of a set of n items is a subset of r of the n items.

$\binom{n}{r}$ n choose r

of r-combinations of n

$$P(n,r) = \binom{n}{r} \cdot r!$$

$$\binom{n}{r} = \frac{P(n,r)}{r!} = \frac{n!}{(n-r)!\, r!}$$

14 people, choose 6 people

$$\binom{14}{6} = \frac{14!}{8!\,6!} = \frac{14\cdot 13\cdot 12\cdot 11\cdot 10\cdot 9\cdot \cancel{8!}}{\cancel{8!}\,6!}$$

$$= \frac{14\cdot 13\cdot \cancel{12}\cdot 11\cdot \overset{2}{\cancel{10}}\cdot \overset{3}{\cancel{9}}}{\cancel{6}\cdot\cancel{5}\cdot 4\cdot\cancel{3}\cdot\cancel{2}\cdot 1} = 3003$$

---

2 people insist on working together

Both are in

$$\binom{12}{4}$$

Neither are in

$$\binom{12}{6}$$

$$\binom{12}{4} + \binom{12}{6}$$

$$\frac{12!}{8!\,4!} + \frac{12!}{6!\,6!}$$

group of 12:

5 men

7 women

5 person group

4 men 1 woman $\binom{5}{4} \cdot \binom{7}{1}$

5 men $\binom{5}{5} = 1$

2 men 3 women $\binom{5}{2} \cdot \binom{7}{3}$

$\frac{5!}{1! \cdot 4!} = 5$

$\frac{7!}{6! \cdot 1!} = 7$

$\frac{5!}{0!5!} = 1$

at least one man

$\binom{5}{1} \cdot \binom{11}{4}$ choose 1 man then everyone else.

$\binom{12}{5} - \binom{7}{5}$

total all women

# of men	
1	$\binom{5}{1} \cdot \binom{7}{4}$
2	$\binom{5}{2} \cdot \binom{7}{3}$
3	$\binom{5}{3} \cdot \binom{7}{2}$
4	$\binom{5}{4} \cdot \binom{7}{1}$
5	$+ \binom{5}{5} \cdot \binom{7}{0}$

$$\sum_{i=1}^{5} \binom{5}{i}\binom{7}{5-i}$$

n elements
r elements $r \leq n$

n^r

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

2^n

$n - r + 1$

$n!$

$P(n,r) = \frac{n!}{r!}$