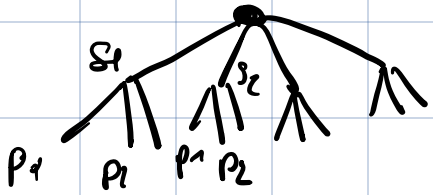
Product Rule

2 tasks. m ways to do 1st, n ways 2nd

$m \cdot n$ total procedures

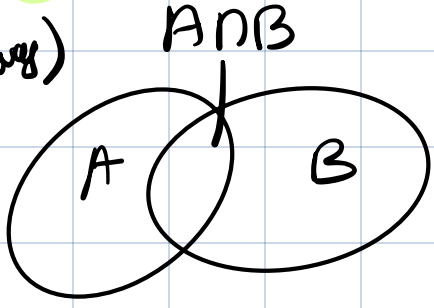


Sum Rule

if task can be done either in one of m ways or in one of n ways, total is $n+m$

Subtract° Rule

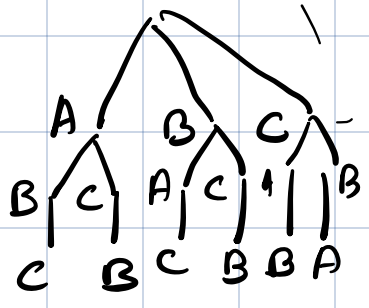
A (set of m ways)



B (set of n ways)

$$|A \cup B| = |A| + |B| - |A \cap B|$$

Permutations



$\Rightarrow$ ordered arrangement of distinct objects $n!$

$$n \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot 1$$

R-Permutations

$$\frac{12!}{8!} = 12 \times 11 \times 10$$

$$P(n,r) \equiv P_r^n = \frac{n!}{(n-r)!}$$

$$= (n) \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot (n-r+1)$$

⚠ By convention, $0! = 1$ (only 1 way to order the empty set)

Combinations

not order, but choose

$$\binom{n}{r} = C(n,r) \equiv C_r^n = \frac{n!}{(n-r)!\,r!}$$

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

"n choose r"

Counting with repetitions

k-permutat° of a set of n obj is

$$n^k$$

Here are $\binom{n+r-1}{r}$ r-combinat° from a set with n-elements w repetit