Mathematics for Computer Science

MIT 6.042J/18.062J

Rules for Counting

Counting in Gambling

What *fraction* of poker hands are "a pair of Jacks?"
(probability of a pair of Jacks)

Counting in Games

different chess positions after n moves?

different positions for a Rubik's cube?

Counting in Algorithms

ops to update a data structure (# comparisons needed to sort n items)

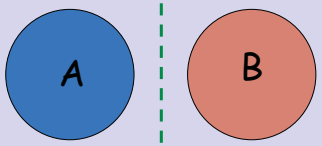
steps in a computation (# multiplies to compute d^n)

Counting in Cryptography

possible passwords

possible keys

Sum Rule



If sets A and B are disjoint, then

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

Sum Rule

- Class has 43 women, 54 men so total enrollment = 43 + 54 = 97
- 26 lower case letters, 26 upper case letters, and 10 digits, so # characters = 26+26+10 = 62

Product Rule

If there are 4 boys and 3 girls, there are

$4 \cdot 3 = 12$

different boy/girl couples

Product Rule

If $|A| = m$ and $|B| = n$, then

$$|A \times B| = m \cdot n$$

$A = \{a, b, c, d\}$, $B = \{1, 2, 3\}$

$A \times B = \{(a,1),(a,2),(a,3),$
$(b,1),(b,2),(b,3),$
$(c,1),(c,2),(c,3),$
$(d,1),(d,2),(d,3)\}$

Product Rule: Counting Strings

length-4 binary strings

$= |B \times B \times B \times B|$

$= |B^4|$ where $B ::= \{0,1\}$

$= 2 \cdot 2 \cdot 2 \cdot 2 = 2^4$

Product Rule: Counting Strings

length n strings from an alphabet of size m is

$$m^n$$

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