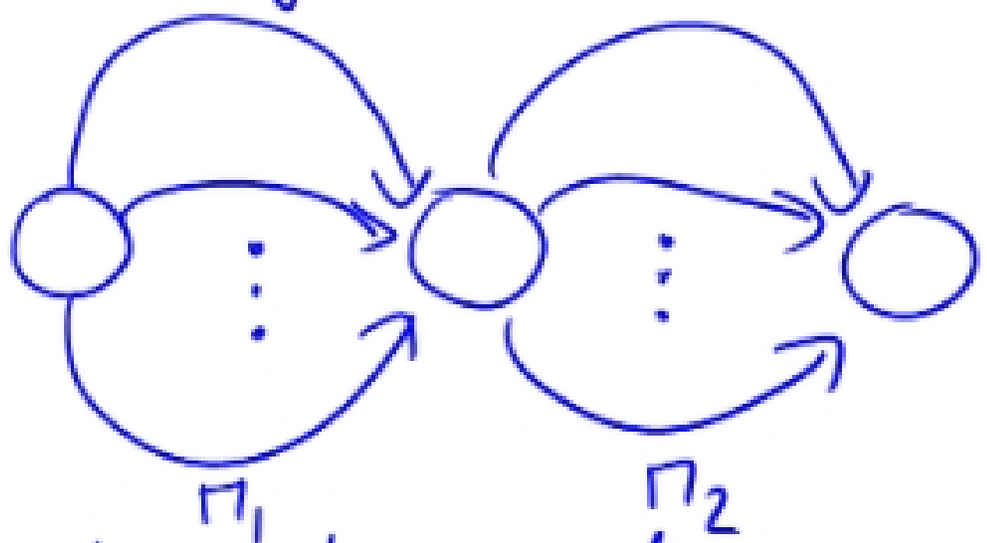
Chapter 5 Counting

Basic Counting Principles

Product rule and sum rule



The Product Rule

Procedure can be broken down into a sequence of two tasks.

Assume there are $\begin{cases} n_1 \\ n_2 \end{cases}$ ways to do the $\begin{cases} \text{first} \\ \text{second} \end{cases}$ task

Then there are $n_1 \cdot n_2$ ways to do the procedure.

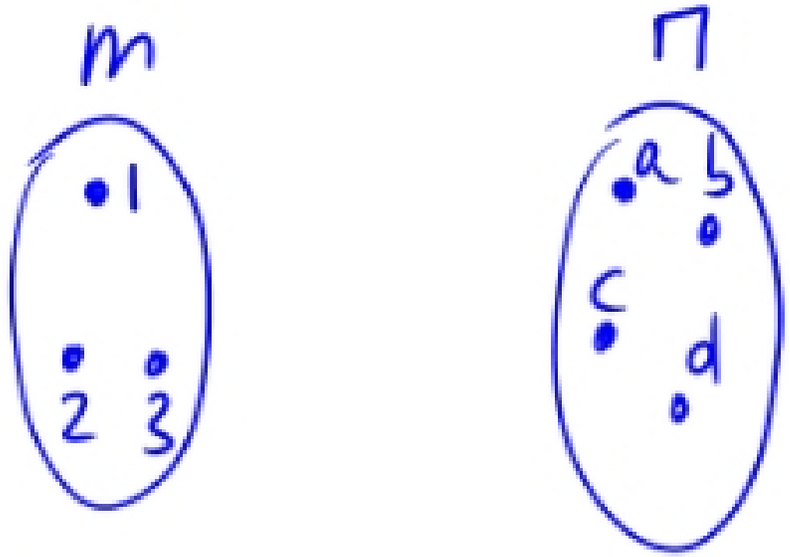
Counting Functions

$|A| = m \quad |B| = n$

How many function $f: A \to B$ are there?

$= m \cdot n$

$= 1$



n^m

$f(1) \quad f(2) \quad f(3)$

a b c d

injective

Counting One-to-One Functions

$f : A \to B$

$|A| = m \qquad |B| = n$

- $n < m$ 0
- $n \geq m$ $n(n-1)\cdots(n-m+1)$

$n!$ $\quad n(n-1)\cdots(n-m+1)\cancel{(n-m)\cdots 1}$

$= \dfrac{}{(n-m)!} = \dfrac{}{\cancel{(n-m)}\cdots 1}$