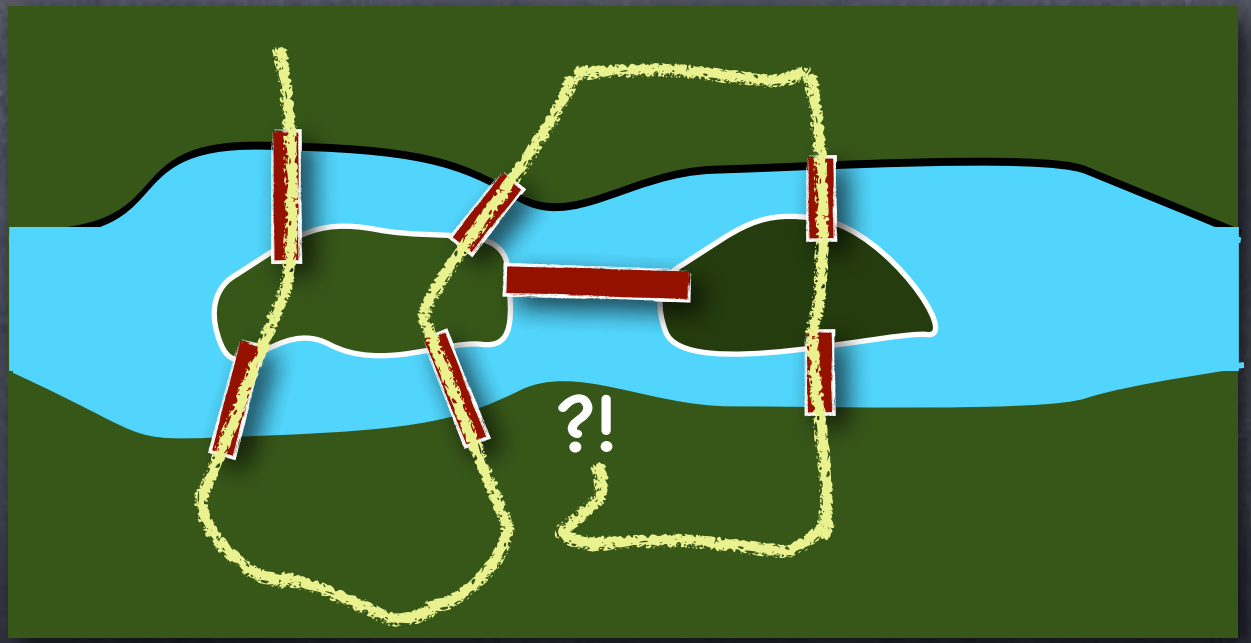
Discrete Structures
(Introduction to Mind Bending)

A flavour

Bridges of Königsberg

- Cross each bridge exactly once



- Is it impossible? How do we know for sure?

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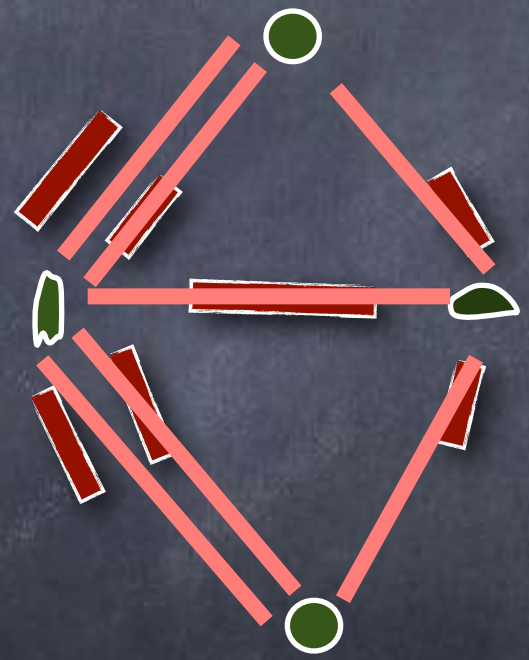

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Discrete Stuff

- Graphs (maps, friendships, www...)
- Patterns, Symmetry
- Numbers
- Logic, reasoning
- (Discrete) Algorithms
- Digital computers...

Pigeonholes & Parties

Suppose you go to a party and there is a game: How many of your "friends" are at the party? (Everyone who goes to the party has at least one person there that he/she counts as a friend.)

There will be at least two who have the same number of friends at the party!

But Why?

Pigeonholes & Parties

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- If there are 4 people in the party, for each person, the number of friends at the party is 1, 2 or 3.
  - There are 4 of you, and everyone needs to pick a number. There are only 3 numbers to pick from...

The Pigeonhole Principle

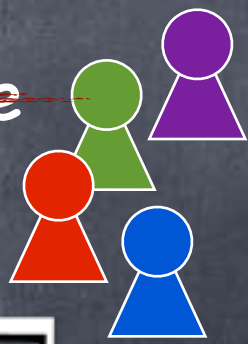
If there are more pigeons than pigeonholes, then at least one pigeonhole will have more than one pigeon in it

Pigeonholes & Parties

So again, suppose you go to a party and there is a game:

How many of your "friends" are at the party?

~~(Everyone who goes to the party has at least one person there that he/she counts as a friend.)~~



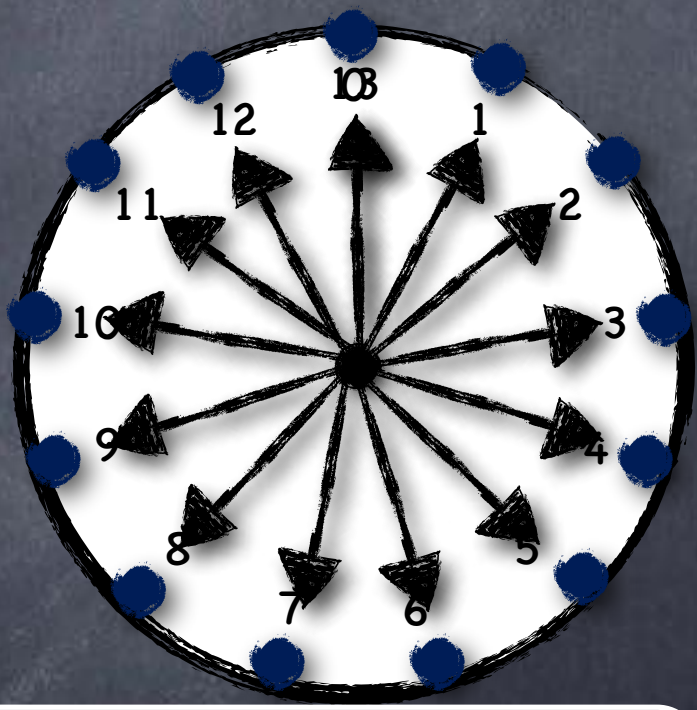
There will be at least two who have the same number of friends at the party!

Point to ponder

Suppose friendships are always reciprocated. Then can you show that the claim holds even if not everyone has a friend at the party?

The Skippy Clock

- Has 13 hours on its dial!
- Needle moves two hours at a time
- Which all numbers will the needle reach?
  - Reaches all of them!



Points to ponder

What if the clock had 12 hours?

What if the needle moved 5 hours at a time?

Topics to be covered