EE360C Algorithms

Dr. David Soloveichik

Who and Where Am I?

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An algorithm is any well-defined computational procedure

We use algorithms for...

- To find the shortest or the best path to travel from one location to another
- To do the weather forecasting
- For finding structural patterns and cure diseases
- For making games like chess that can defeat the best human in it
- For building smart robots (like drones)
- To route messages over the internet
- ...

Challenge

- Hard to design algorithms that are
  - correct
  - efficient
- Often don’t have to reinvent the wheel!

Correctness

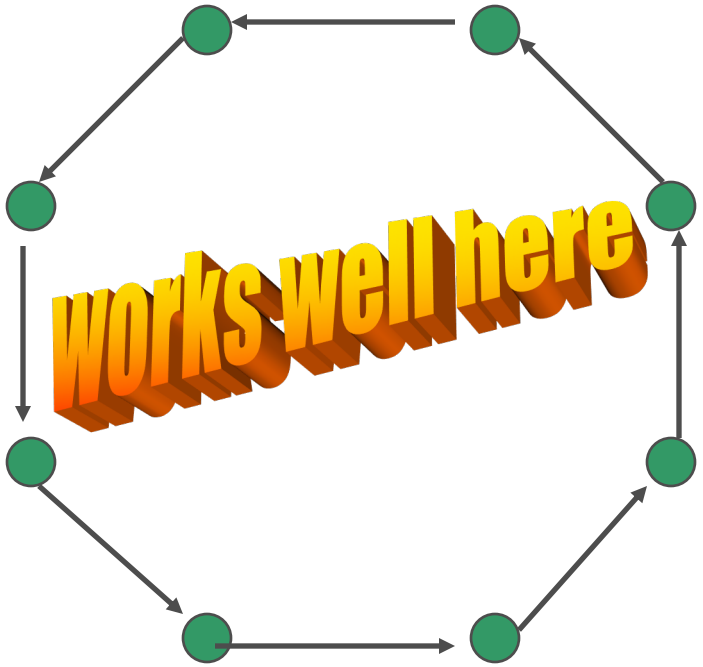
- How do you know an algorithm is correct?
  - produces the correct output on every input
- Since there are infinitely many inputs, it is not trivial
- Saying "it's obvious" can be dangerous
  - often one's intuition is tricked by one particular kind of input

Tour Finding Problem

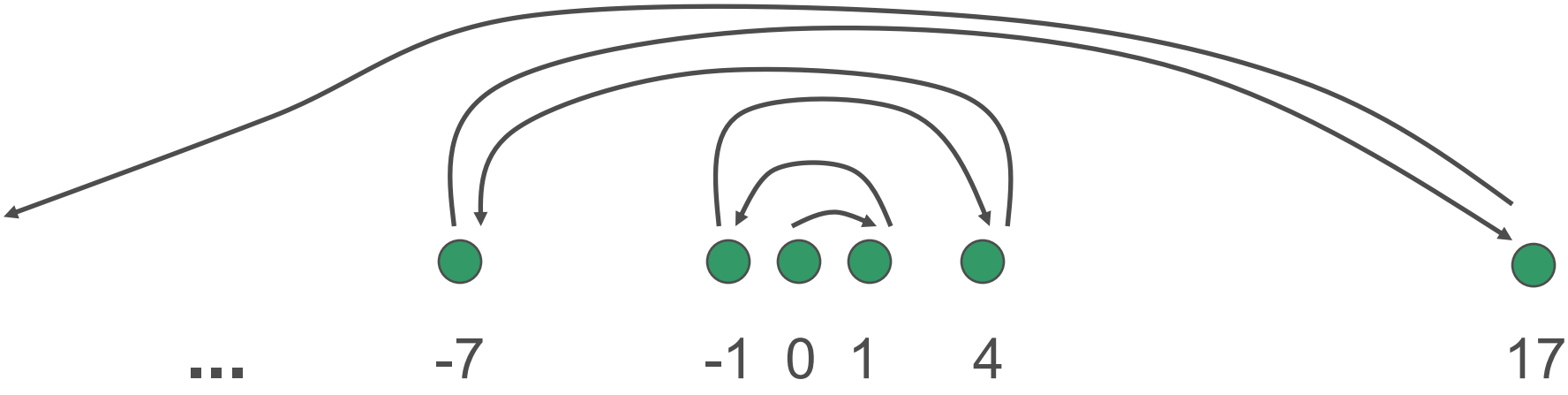
- Given a set of *n* points in the plane, what is the shortest tour that visits each point and returns to the beginning?
  - application: robot arm that solders contact points on a circuit board; want to minimize movements of the robot arm
- How can you find it?

Finding a Tour: Nearest Neighbor

- start by visiting given start point
- while not all points are visited
  - choose unvisited point closest to last visited point and visit it
- return to start point



Nearest Neighbor Counter-example



works poorly here

How can we prove correctness?

Don’t be scared of *proofs*.

Just think: *“convincing argument”*

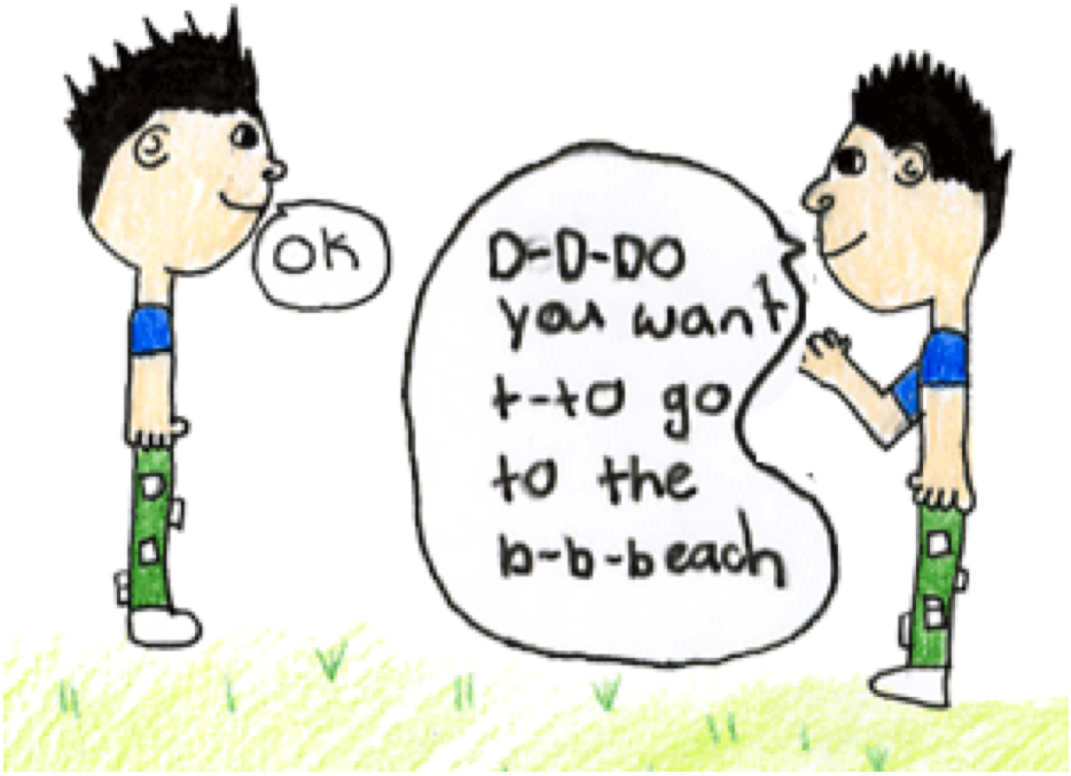
My research interests:

Natural computing: computation inspired by nature From our brains to the regulatory networks of bacteria, nature provides fascinating examples of information processing, which is quite different from electronic computers.

Distributed computing: Formal models of distributed computing help us to discover the potential and limits of chemical information processing.

Molecular programming: engineering smart molecules We use chemistry as a "programming language".

I have a disability: stuttering



Office hours

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This week: Thu 6:30-7:30pm or after class

(later TBD)