ALGOLAB TUTORIAL #10

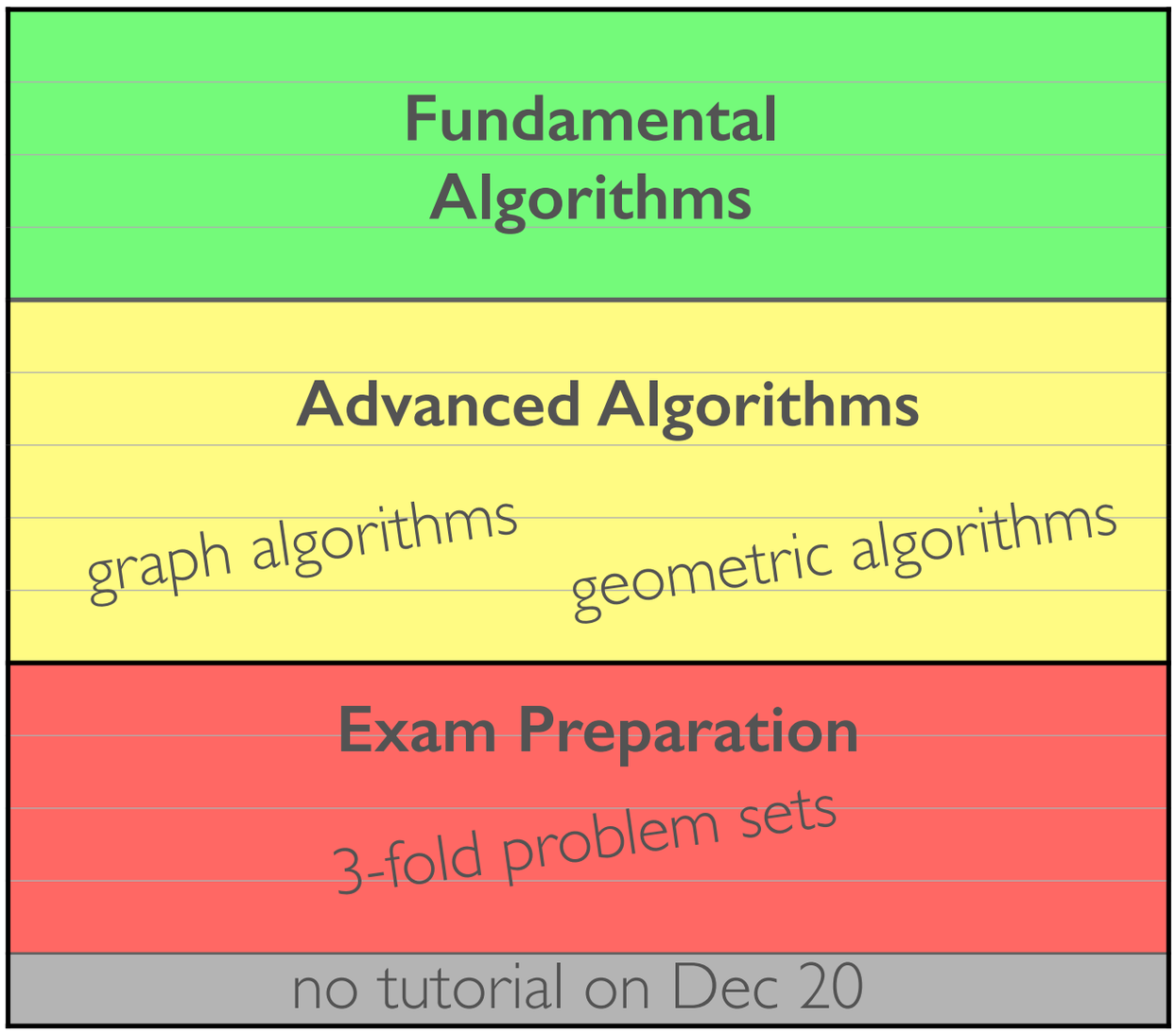
Exam Preparation Week 1

Contents

- How to solve Algolab problems (meta-guidelines)
- 3-Fold Problem: Moretorcycles

ALGOLAB TIMELINE

we are here →



Exam (afawk): Fr, Feb 2 and Tu, Feb 6, 2018, 13-19.

TEST EXAM

Date/time: Tu, **Dec 12, 2017, 17:00-19:15**, ETH HG.

Be there in time!

No PotW on Mon, Dec 11, 2017.

Participation is optional and has no effect on the grade.
Prerequisite: Being registered, bring student ID.
We will post the room assignment on moodle.

Computer activity (screen) is logged during all exams.

JUDGE DOC

Documentation is complete now. Go and check!

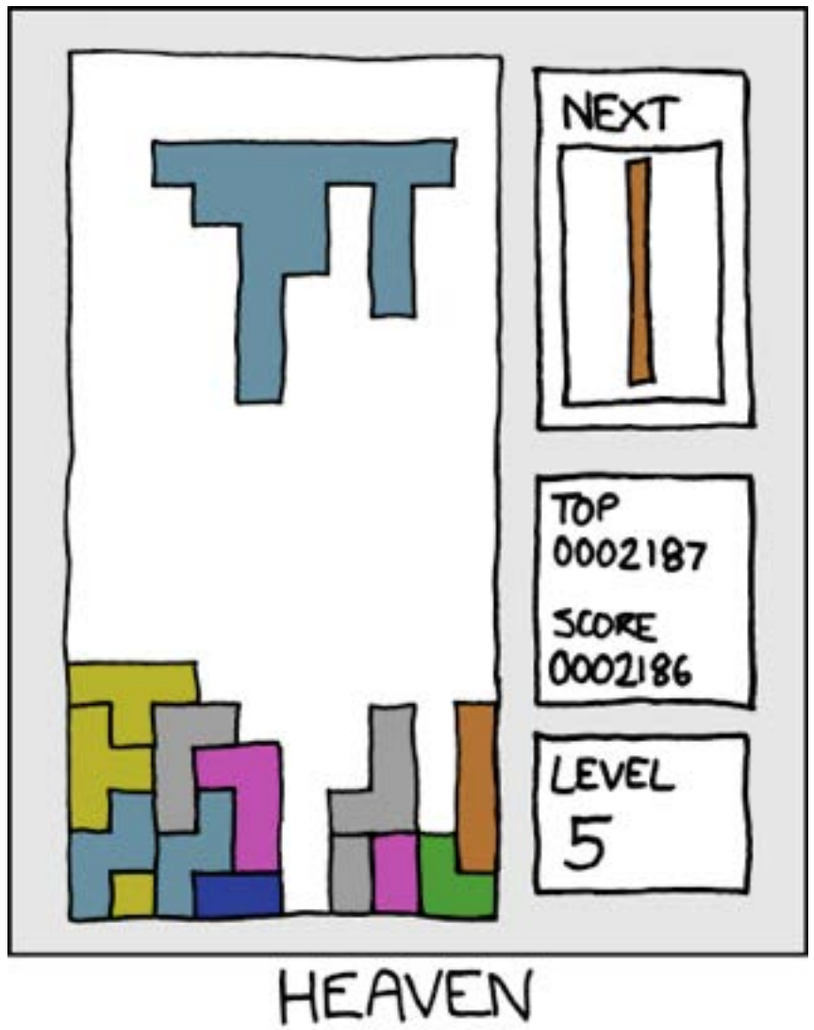
These are the last slides that will be put there.

No solutions.

Configuration files, scripts, etc. can be proposed until **Dec 6, 2017, 17:00** Zurich time (see forum post).

HOW TO SOLVE PROBLEMS

- Know what to know
- Understand your task
- Find an appropriate model
- Design an efficient algorithm
- Implement that algorithm
- Avoid "stupid" mistakes



http://xkcd.com/888/

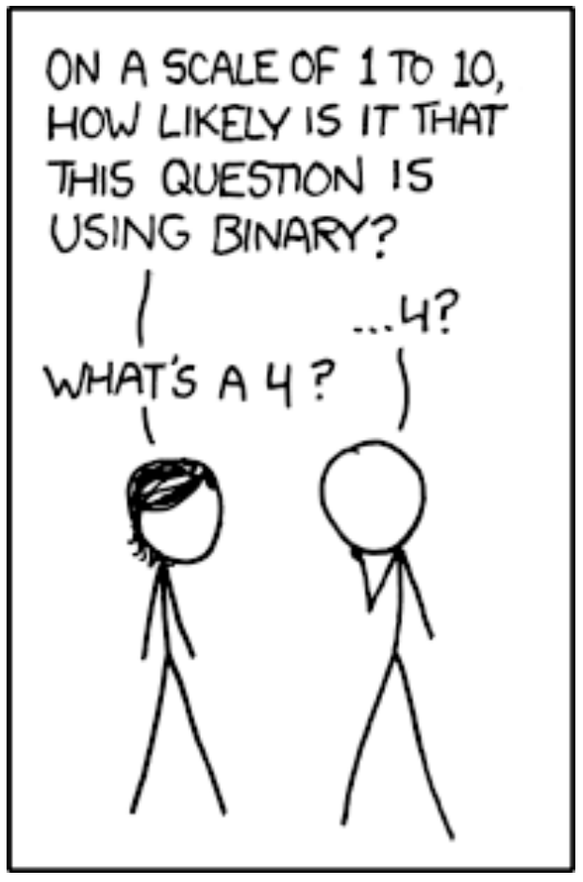
KNOW WHAT TO KNOW

- Both the material from the tutorials and the collection of problems form the contents of this course.
- Key concepts, techniques, and skills were covered in the tutorials and/or practiced in a problem.
- Also meta skills such as time management play a role here (practiced in PotWs).

KNOW WHAT TO KNOW

- We will not ask you to do something drastically different from what you have seen during the semester.

  The problems from the exam preparation weeks give you a good idea of how problems in the exam may look like.



http://xkcd.com/953/

- If you use a data structure/algorithm/technique that was not covered, you are most likely not solving the problem in a way we intended.

  You go down a risky road. If that works out, kudos to you for the original approach! If not ... you knew the risks ...

UNDERSTAND YOUR TASK

- Read the problem statement carefully.
- Read the problem statement again.

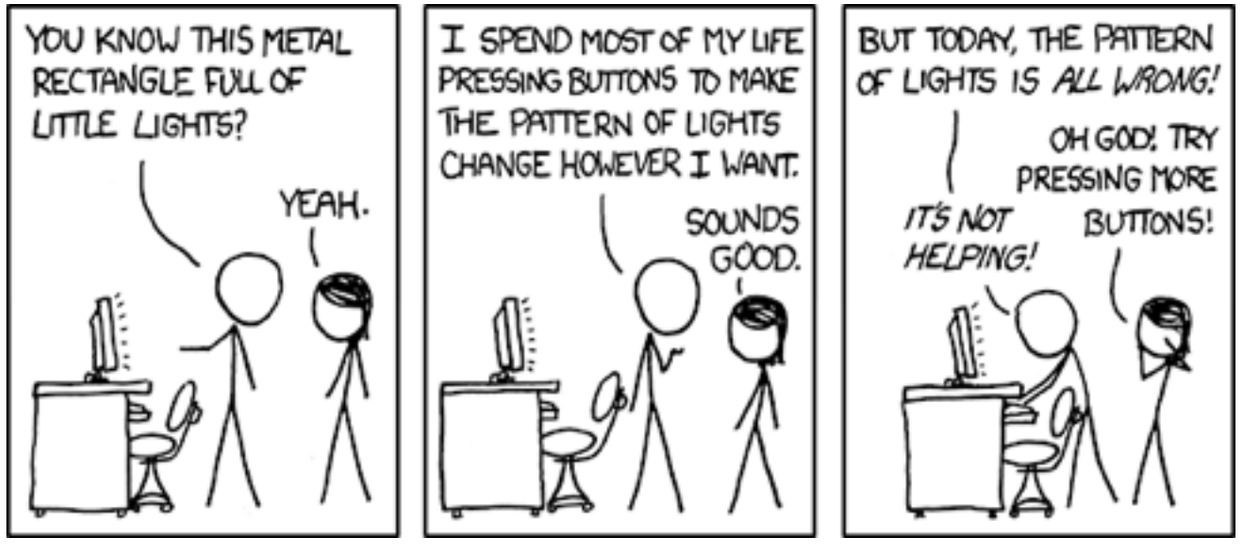
Make sure that you understand what is asked. Do not make any assumptions/ interpretations that are not clearly supported by what is written.

- Check the provided example(s) and if they concur with your understanding.

These examples are part of the problem description.

- If (and only if) you think the problem is not clearly stated, ask for a clarification on the judge.

Clarifications are not there to confirm your understanding. The answer will be: ``The problem statement is clear.'' - unless the examiners agree it is not clear.



http://xkcd.com/722/

FIND A MODEL

Rephrase the problem in abstract/ mathematical terms.

- (using terms like graph, vertex, edge, component, matching, point, line, matrix, relation, inequality, ...) rather than planes, aliens, countries, or antennas.
- Sometimes this task is straightforward and sometimes there are choices to make.
- The goal is to get rid of the story and unveil the algorithmic problem.

Body of Knowledge (Jaume Plensa, 2010)

ALGORITHM DESIGN

- How can you attack this problem?
- Do not get caught in the story!

You should let yourself get inspired by what you already know. Not on the story-level, but on the algorithmic level instead!

- Try to think about different alternatives: evaluate them briefly, which look promising?

  (LP, network flow, maximum matching, dynamic programming, Delaunay/Voronoi, minimum enclosing shapes, greedy, scan, binary search, shortest paths,…)

- Make a runtime analysis!

  Does your bound match the problem specification?

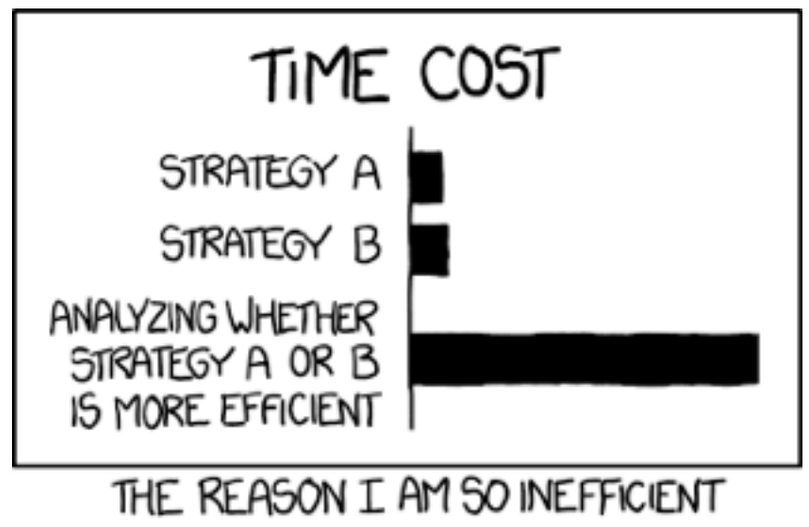
IMPLEMENTATION

- Every problem can be solved with no more than ~100 lines of well-written code.
- Use suitable data types for input/output processing (precision vs. speed).

Unlike for some earlier problems we will not tell you which type to use, because you were taught all the necessary bits...

- Avoid premature optimizations.
- Practice helps a lot...

That's why this is a lab. The more you practice, the less likely it is that you run into a particular issue for the first time during the exam...



http://xkcd.com/1445/

TIME MANAGEMENT

- Look at all problems!

  The order of problems is random.
  There are no "easy" or "difficult" problems.

- Consider partial solutions.

  The exam problems are designed so that every student must be able to get ~50 points.

- Keep an eye on time and evaluate:

  How close are you to the solution?

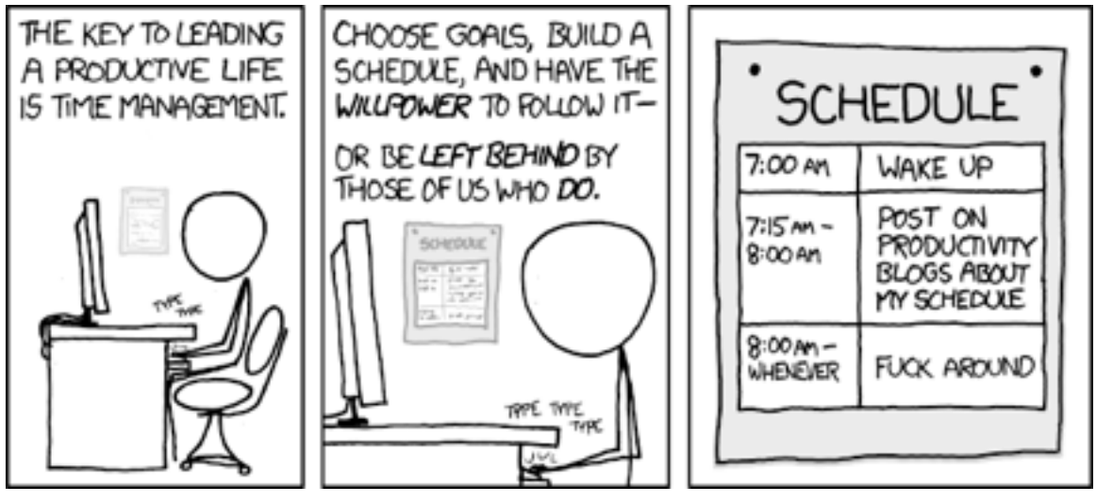
- If you are stuck, consider alternative approaches

  even better: consider alternatives before starting to work out details

- or switch to another problem.

  You can always come back later.

- Practice helps...

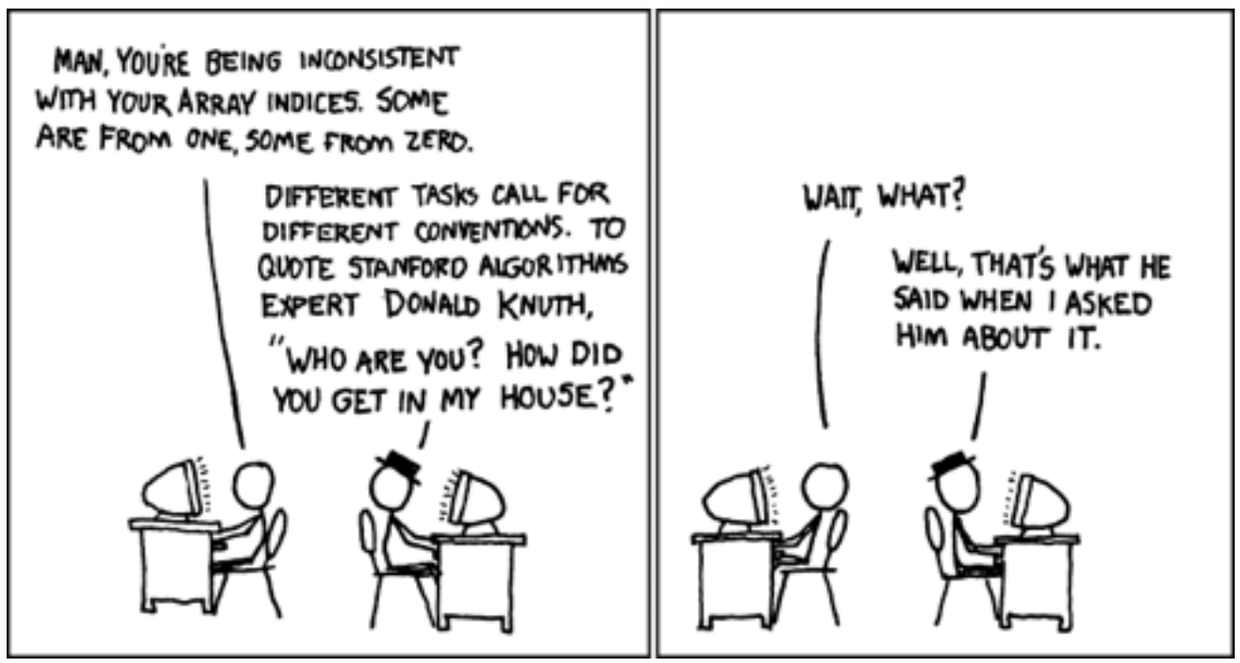


http://xkcd.com/874/

AVOID "STUPID" MISTAKES

- Submit to the right problem (correct link).
- Read all input, even if the result is determined half the way along already. Otherwise, you mess up a possibly following problem instance.
- Don't call `solve_quadratic_program` to solve linear programs.
- `TMMTL ...`

Practice helps...



http://xkcd.com/1445/

PREPARATION

- Go over all problems and note:
- What is the essence of the problem?
- Which techniques are needed to solve it?
- Why do these techniques work here?
- Why do other conceivable techniques not work?
- How long did I work to solve it? Where did I spend how much time? Where did I struggle most?

QUESTIONS
FOUND IN GOOGLE AUTOCOMPLETE

WHY DO WHALES JUMP
WHY ARE WITCHES GREEN
WHY ARE THERE MIRRORS ABOVE BEDS
WHY DO I SAY UH
WHY IS SEA SALT BETTER
WHY ARE THERE TREES IN THE MIDDLE OF FIELDS
WHY IS THERE NOT A POKEMON MMO
WHY IS THERE LAUGHING IN TV SHOWS
WHY ARE THERE DOORS ON THE FREEWAY
WHY ARE THERE SO MANY SVCHOST.EXE RUNNING
WHY AREN'T THERE ANY COUNTRIES IN ANTARCTICA
WHY ARE THERE SCARY SOUNDS IN MINECRAFT
WHY IS THERE KICKING IN MY STOMACH
WHY ARE THERE TWO SLASHES AFTER HTTP
WHY ARE THERE CELEBRITIES
WHY DO SNAKES EXIST
WHY DO OYSTERS HAVE PEARLS
WHY ARE DUCKS CALLED DUCKS
WHY DO THEY CALL IT THE CLAP
WHY ARE KYLE AND CARTMAN FRIENDS
WHY IS THERE AN ARROW ON AANG'S HEAD
WHY ARE TEXT MESSAGES BLUE
WHY ARE THERE MUSTACHES ON CLOTHES
WHY ARE THERE MUSTACHES ON CARS
WHY ARE THERE MUSTACHES EVERYWHERE
WHY ARE THERE SO MANY BIRDS IN OHIO
WHY IS THERE SO MUCH RAIN IN OHIO
WHY IS OHIO WEATHER SO WEIRD
WHY ARE THERE MALE AND FEMALE BIKES
WHY ARE THERE BRIDESMAIDS
WHY DO DYING PEOPLE REACH UP
WHY AREN'T THERE VARGOSE ARTISTS
WHY ARE OLD KLINGONS DIFFERENT
WHY IS PROGRAMMING SO HARD
WHY IS THERE A 0 OHM RESISTOR
WHY DO AMERICANS HATE SOCCER
WHY DO RHYMES SOUND GOOD
WHY DO TREES DIE
WHY IS THERE NO SOUND ON CNN
WHY AREN'T POKEMON REAL
WHY AREN'T BULLETS SHARP
WHY DO DREAMS SEEM SO REAL

WHY AREN'T THERE DINOSAUR GHOSTS

WHY DO TESTICLES MOVE
WHY ARE THERE PSYCHICS
WHY ARE HATS SO EXPENSIVE
WHY IS THERE CAFFEINE IN MY SHAMPOO
WHY DO YOUR BOOBS HURT

WHY DO IGUANAS DIE

WHY ARE THERE SLAVES IN THE BIBLE
WHY DO TWINS HAVE DIFFERENT FINGERPRINTS
WHY ARE AMERICANS AFRAID OF DRAGONS

WHY IS HTTPS CROSSED OUT IN RED
WHY IS THERE A LINE THROUGH HTTPS
WHY IS THERE A RED LINE THROUGH HTTPS ON FACEBOOK
WHY IS HTTPS IMPORTANT

WHY IS YKK ON ALL ZIPPERS

WHY ARE THERE WEEKS
WHY DO I FEEL DIZZY

WHY AREN'T ECONOMISTS RICH
WHY DO AMERICANS CALL IT SOCCER
WHY ARE MY EARS RINGING
WHY ARE THERE SO MANY AVENGERS
WHY ARE THE AVENGERS FIGHTING THE X MEN
WHY IS WOLVERINE NOT IN THE AVENGERS

WHY ARE THERE SWARMS OF GNATS
WHY IS THERE PHLEGM

WHY IS THERE LAVA

WHY ARE THERE SO MANY CROWS IN ROCHESTER, MN
WHY IS PSYCHIC WEAK TO BUG
WHY DO CHILDREN GET CANCER
WHY IS POSEIDON ANGRY WITH ODYSSEUS
WHY IS THERE ICE IN SPACE

WHY ARE THERE ANTS IN MY LAPTOP

WHY IS THERE HELL IF GOD FORGIVES

WHY IS EARTH TILTED
WHY IS SPACE BLACK
WHY IS OUTER SPACE SO COLD
WHY ARE THERE PYRAMIDS ON THE MOON
WHY IS NASA SHUTTING DOWN

WHY ARE THERE FEMALE MR MIMES

WHY IS THERE AN OWL IN MY BACKYARD
WHY IS THERE AN OWL OUTSIDE MY WINDOW
WHY IS THERE AN OWL ON THE DOLLAR BILL
WHY DO OWLS ATTACK PEOPLE
WHY ARE AK47s SO EXPENSIVE
WHY ARE THERE HELICOPTERS CIRCLING MY HOUSE
WHY ARE THERE GODS
WHY ARE THERE TWO SPOCKS

WHY ARE THERE SQUIRRELS

WHY ARE THERE TINY SPIDERS IN MY HOUSE
WHY DO SPIDERS COME INSIDE
WHY ARE THERE HUGE SPIDERS IN MY HOUSE
WHY ARE THERE LOTS OF SPIDERS IN MY HOUSE
WHY ARE THERE SPIDERS IN MY ROOM
WHY ARE THERE SO MANY SPIDERS IN MY ROOM
WHY DO SPIDER BITES ITCH
WHY IS DYING SO SCARY

WHY IS THERE NO GPS IN LAPTOPS
WHY DO KNEES CLICK
WHY AREN'T THERE E GRADES
WHY IS ISOLATION BAD
WHY DO BOYS LIKE ME
WHY DON'T BOYS LIKE ME
WHY IS THERE ALWAYS A JAVA UPDATE
WHY ARE THERE RED DOTS ON MY THIGHS
WHY IS LYING GOOD

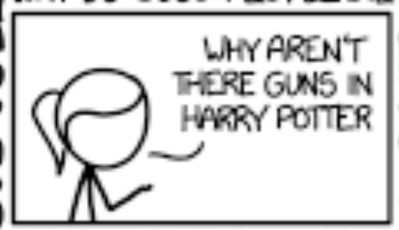
WHY IS GPS FREE

WHY IS SEX SO IMPORTANT

WHY IS MT VESUVIUS THERE
WHY DO THEY SAY T MINUS
WHY ARE THERE OBELISKS
WHY ARE WRESTLERS ALWAYS WET
WHY ARE OCEANS BECOMING MORE ACIDIC
WHY IS ARWEN DYING
WHY AREN'T MY QUAIL LAYING EGGS
WHY AREN'T MY QUAIL EGGS HATCHING
WHY AREN'T THERE ANY FOREIGN MILITARY BASES IN AMERICA

WHY IS LIFE SO BORING

WHY ARE MY BOOBS ITCHY
WHY ARE CIGARETTES LEGAL
WHY ARE THERE DUCKS IN MY POOL
WHY IS JESUS WHITE
WHY IS THERE LIQUID IN MY EAR
WHY DO Q TIPS FEEL GOOD
WHY DO GOOD PEOPLE DIE



WHY ARE ULTRASOUNDS IMPORTANT
WHY ARE ULTRASOUND MACHINES EXPENSIVE
WHY IS STEALING WRONG

WHY ARE THERE DOGS AFRAID OF FIREWORKS
WHY ARE THERE NO KING IN ENGLAND

3-FOLD PROBLEMS

- **Goal:** practice problem modeling and algorithm design, a.k.a. "how do I approach a problem"
- 3 "similar" problems: subtle differences in formulation make different strategies and techniques viable
- You work individually here during the tutorial

  You have 45min. ➠ until 18:0X
- Then we discuss possible solutions.