Here are some of the things we discussed in our first week. Most of this material was taken directly from Polya[1] or from the course textbook[2]. Notes written on the board or ideas discussed are not included in these notes.

Part I – Introduction to computing

- Polya, stages of problem solving, watching ourselves think it through.
- Algorithms, what an algorithm is, what kind of algorithms concern us in computing.

Polya – How to solve it

- Polya's book is unique because it does not solve any problems – it examines how we figure things out.
  - **Phase 1:** Understand the problem
  - **Phase 2:** Devise a plan for solving the problem
  - **Phase 3:** Carry out the plan
  - **Phase 4:** Evaluate the solution for accuracy & for its potential as a tool for solving other problems.
- These are not discrete steps, but rather states we evolve through as we work through the problem.

Getting There

Polya devotes approximately 30 pages to the description of the stages and over 200 pages to the techniques that we use:

- Analogy
- Auxiliary elements
- Auxiliary problems
- Bright idea
- Can you use the result?
- Decomposing & recombining
- Definition
- Examine your guess
- Figures
- Stepwise refinement
- Have you seen it before?
- Induction
- Subconscious work
- Did you use all the data?
- Look at the unknown
- Working backwards

How do we solve problems?$_2$

- Person A must figure out the age of person B's three children.
- B tells A that the product of their ages is 36.
- After considering this clue, A tells B that she needs another clue.
- B then tells A the sum of the children's age.
- A tells B she still needs another clue.
- B then tells A that she must pick up the eldest from soccer.
- A then tells B their ages.

What are their ages?

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[1] Polya, G., *How to solve it: A new aspect of mathematical method*, Second edition, Princeton University Press, 1957.

[2] Brookshear, J. Glenn, *Computer science: an overview*, 8th edition, Chapter 5, Pearson Education.

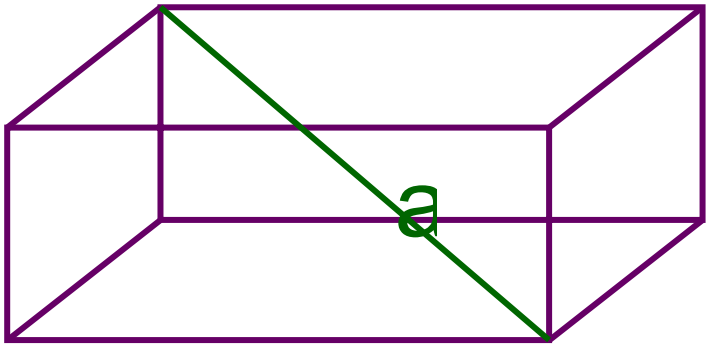
Watch yourself think it through

Now try this one$_2$
Before A, B, C and D ran a race they predicted:

- A predicted that B would win
- B predicted that D would be last
- C predicted that A would be third
- D predicted that A's prediction would be correct
- Only one of these predictions was true, and this was the prediction made by the winner.

In what order did they finish the race?
Watch yourself think

What is the length of a?$_1$



Flag on a building$_2$

- You have been asked to erect a flag at the centre of the roof of a 20' by 30' building.
- The flag is tethered by 4 (equal-sized) cords which attach the top of the four foot flagpole to each corner of the building.
- What is the length of each cord?

Lecture 2 – new material

Slake that thirst ☺

- Your local store has agreed to give you a free bottle of your favourite beverage for every three empty bottles that your return.
- Your friend has lots of empty bottles to lend you providing you return them to her.
- You have enough money for 4 bottles.
- How would you maximize the amount your get?
- What about if you had money for **n** bottles?

What is an algorithm?

- Almost everything we do in everyday life can be classified as an algorithm:
  - ☻ Recipes
  - ☻ Walk to school
  - ☻ Make dinner
  - ☻ …

What is an algorithm?
More formally:
DEF: An algorithm is an ordered set of unambiguous executable steps that define a terminating process.[2]

Representing algorithms

- The notation used to represent an algorithm is not to be confused with the actual algorithm.
- A single algorithm can be represented many ways.
- The algorithm remains constant – it is the notation which changes.

Flowcharts to describe algorithms