

Problem Solving?

I thought this was a programming class

Why problem solving?

“Consider programming itself a form of problem solving: only through complete understanding of a problem and its solution can you express a correct program for it, and only through constructing and testing a program can you be certain that your understanding is complete.”

-Programming, pg 12

Can you learn to problem solve?

- There is no course in how to solve problems.
- Every problem is different but we can learn a basic set of steps to solve a problem.
- George Polya in 1945 wrote a text on solving math problems.
- It can be applied to many problem domains.
- This book changed how people thought about solving problems.

The 4 Steps

1. Understand the problem
2. Devising a plan
3. Carrying out the plan
4. Looking back

Understanding the Problem

What is the unknown? What are the data? What is the condition?

Is it possible to satisfy the condition? Is the condition sufficient to determine the unknown? Or is it insufficient? Or redundant? Or contradictory?

Draw a figure. Introduce suitable notation.

Separate the various parts of the condition.

Can you write them down?

Devising a Plan

Have you seen it before? Or have you seen the same problem in a slightly different form?

Do you know a related problem? Do you know a theorem that could be useful?

Look at the unknown! And try to think of a familiar problem having the same or a similar unknown.

Devising a plan

Here is a problem related to yours and solved before. Could you use it? Could you use its result? Could you use its method? Should you introduce some auxiliary element in order to make its use possible.

Could you restate the problem? Could you restate it still differently? Go back to definitions

Devising a plan

If you cannot solve the proposed problem try to solve first some related problem. Could you imagine a more accessible related problem? A more general problem? A more special problem? Keep only part of the condition, drop the other part; how far is the unknown then determined, how can it vary? Could you derive something useful from the data? Could you think of other data appropriate to determine the unknown?

Devising a plan

Could you change the unknown or the data, or both if necessary, so that the new unknown and the new data are nearer to each other.

Did you use all the data? Did you use the whole condition? Have you taken into account all the essential notions involved in the problem?

Carrying out the plan

Carrying out the plan of the solution, *check each step*. Can you see clearly that the step is correct? Can you prove that it is correct?

Looking back

Can you *check the result*? Can you check the argument?

Can you derive the result differently? Can you see it at a glance?

Can you use the result, or the method, for some other problem?