

If there is a problem you can't solve, then there is an easier problem you can solve: find it.

George Polya

Opportunity is missed by most people because it is dressed in overalls and looks like work.

Thomas Edison

It is the mark of an educated mind to be able to entertain a thought without accepting it.

Aristotle

“Eighty percent of success is showing up.” Woody Allen

“Success is 1% inspiration and 99% perspiration.” Thomas Edison

The Principle of Intimate Engagement: You must commit to the problem

“Roll up your sleeves”

“Get your hands dirty.”

Easy problems: you can just "see the answer"

Medium problems: you can see the answer once you engage

Hard problems: you need strategies for coming up with a potential solution, sometimes for even getting started

There are few, if any, objective criteria for deciding whether a given problem is easy, medium or hard.

What is hard for one solver may be easy for another.

What is hard for you under some conditions may be easy for you under different conditions.

Effective:

Believe that problems can be solved through the use of heuristics and careful persistent analysis

Ineffective:

Believe ``You either know it or you don't.''

Effective:

Active in the problem-solving process: draw figures, make sketches, ask questions of themselves and others.

Ineffective:

Don't seem to understand the level of personal effort needed to solve the problem.

Effective:

Take great care to understand all the facts and relationships accurately.

Ineffective:

Make judgments without checking for accuracy

Need the attributes of **confidence** and **concentration**

Confidence comes with practice

Attack a new problem with an optimistic attitude

Unfortunately, it takes time

You can't turn it on and off at will

Need to develop a life-long habit

Engagers typically have a history of success with problem solving.

Dismissers have a history of failure.

You might be an engager for one type of problem, and a dismitter for another.

You can “intervene with yourself” to change your attitude of dismissal.

Many students do significant problem solving for recreation
Sudoku, computer games, recreational puzzles.

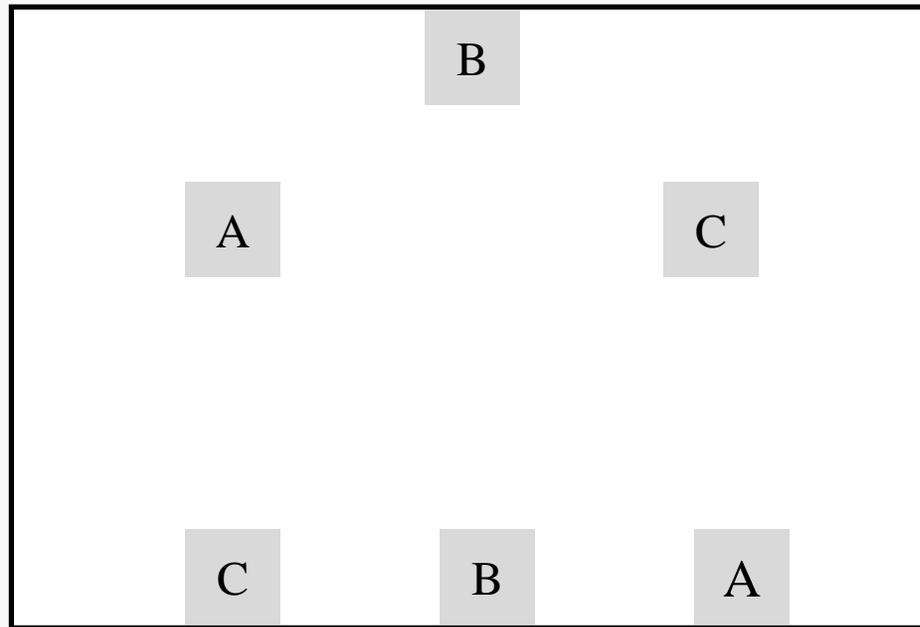
These same students might dismiss math and analytical computer science problems due to a historical lack of success (the mental block)

To be successful in life you will need to find ways to get over any mental blocks you have

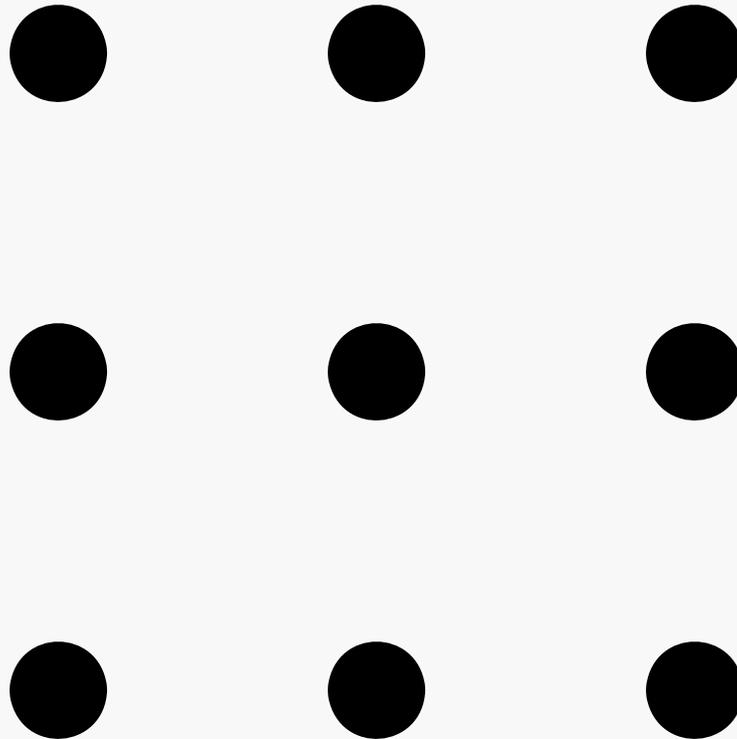
Learn to transfer successful problem-solving strategies from one part of your life to other parts.

Example: Writing is a lot like programming.

Connect each box with its same-letter mate without letting the lines cross or leave the large box.



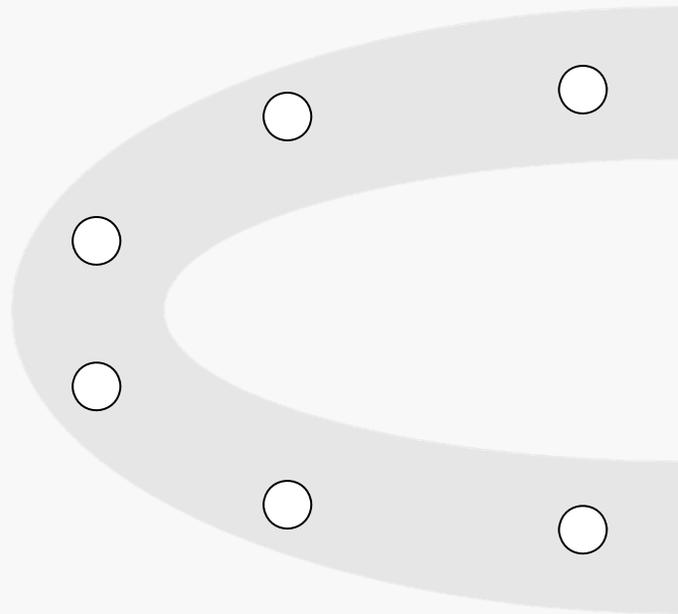
Draw a continuous polygonal line that passes through each circle exactly once.



Engagement Example

The picture below shows a horseshoe with six nail holes.

Can you make two straight cuts that result in six pieces, each containing a single nail hole?

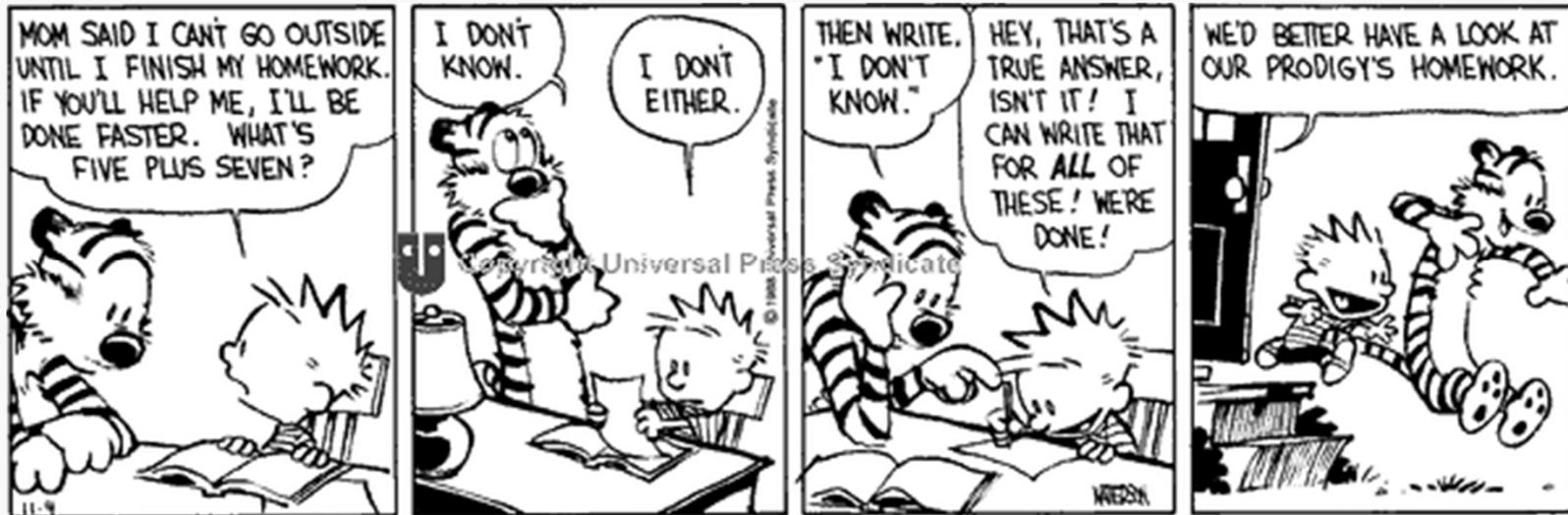


Michalewicz²

Cryptoarithmic problem:

$$\begin{array}{r} A \\ + D \\ \hline D D \end{array}$$

Levine



Levine

Repairing something (dryer, toaster, etc.)

Dryer example: Clean it out

Table example: Look for the loose parts

Car seat example: Reattach spring wire

“Taking the time”

You **can** screw something up or do something dangerous. But often you are not faced with such a prospect.

Some domains require that you study/practice/build expertise to be effective

The act of engagement can help you build domain knowledge

Writing/programming/project procrastination

Just sit down and write, don't care about quality to start

Write whatever part of the document/program appeals. Don't do it start to finish.

Do part of it at a time, over time

People don't write books, they write sections or pages

People don't write programs, they write functions, etc.

Schedule to work. Milestones, etc.

Commit to someone outside if that helps

Invent deadlines if you are deadline-driven

