Problem Solving and Top-Down Design

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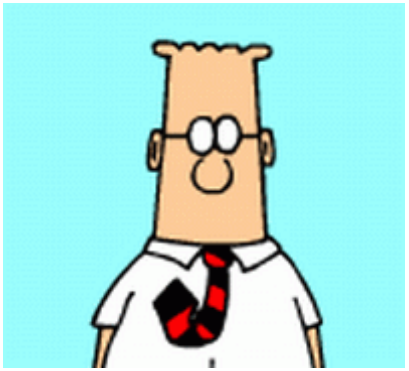
How to Solve Problems

```
// Is there a problem?
if (no_problem)
   relax;
// Is this really a problem?
else if (imaginary_problem)
   relax;
// Is this my problem?
else if (someone_else's_problem)
   relax;
// Is this my first priority problem?
else if (not_first_priority) // Prioritize!!!
   try to solve the first priority problem first;
// Pseudocode continues on the next page.
```



How to Solve Problems (cont'd)

```
// Is this problem solvable?
// (Is it possible to satisfy the condition?)
else if (definitely_unsolvable)
   try to solve the second priority problem;
// Check the data. Garbage In — Garbage Out!!!
else if (bad_data || insufficient_data)
   make sure that you have reliable and sufficient data;
```

How will I recognize a solution?

```
// Has this problem been solved before?
if (solved_before)
   // Is the solution available to you?
   if (solution_available)
      // Can it be used?
      if (solution_can_be_used) // Check it!
```

How to Solve Problems (cont'd)

```
if (solution_works) {
    time permitting, see if you can find a more efficient
        solution;
    by the deadline, use the best working solution found;
}
else // i.e., if the existing known solution doesn't work
  if (solution_can_be_fixed_quickly)
    fix the solution to make it work;
  else
    search for a working solution as described below;
else // i.e., if the existing known solution cannot be used
  if (solution_can_be_modified && used)
  use the modified solution;
```

How to Solve Problems (cont'd)

```
            else // cannot modify and use
               develop an alternative solution;
   else // i.e., if the existing solution is unavailable
      // Can it be reverse engineered quickly?
      if (can_reverse_engineer_quickly && use)
         no comments;
         // Some problems are reverse engineering problems
      else develop an alternative solution;
else // i.e., if the problem is new
   if (similar_problem_solved)
      // Make The Robustness Assumption
      see if your problem can be solved similarly;
   else { // i.e., if the problem is original
      see if a simple solution presents itself; if (so) check it;
```

How to Solve Problems (cont'd)

// For every complex problem there is a simple solution that is
// wrong. *George Bernard Shaw (1856-1950), Irish playwright*
// *and critic.* For every complex problem, there is a solution
// that is simple, neat, and wrong. *H. L. Mencken (1880-1956),*
// *American writer.*

see if the problem can be partitioned into subproblems that
can be solved separately; // **Divide and Conquer!**
} // end the else clause

Algorithm as a Form of Solution

- Algorithm development
  - Analyze the problem
  - Propose an algorithm
  - Test the algorithm
- Implementation
  - Code (translate into a programming language)
  - Test correctness of the algorithm and its implementation
- Maintenance
  - Use the program
  - Modify the program

Top-Down Design