P11-12

Electrical engineers draw diagrams of circuit boards to help them visualize the relationships among a computer’s components.

Architects and engineers draw blueprints, i.e., technical drawings, to express their design ideas in a visual form.

A diagram can show positional relationships far more easily and clearly than a verbal description can.

A diagram can help clarify ideas and solve problems that lend themselves to visual representations.

P28

A system is any procedure that allows you to do something, such as organize information, in a methodical way.

P31

The benefit of making systematic lists is that it allows you to freeze an entry in the list while you work on the other entries until you’ve exhausted all the possibilities.

A tree diagram is a type of systematic list in which options are shown in a branching structure.

P41

A tree diagram is a type of systematic list used to organize information spatially and resembles the branching structure of a tree.

The connecting lines in a tree diagram represent different processes or relationships.

P52

When using the eliminating possibilities strategy, you seek contradictions by making an assumption, applying the assumption, and evaluating the outcome. If the outcome shows that the assumption was incorrect, you eliminate the assumption as a possibility and move on. If the assumption is correct, all you know is that an existing possibility is still a possibility.

P74, 77, 87-94, 511

A matrix is a table that allows you to organize the information in a problem into rows and columns where each cell shows the one-to-one correspondence between the categories represented by the intersecting row and column. Matching the row information to the associated column information, or vice versa, requires clues and logic. Matrix logic is a strategy based on things that cannot be and so it facilitates ideas from the eliminating possibilities strategy.

A one-to-one correspondence is a linking of elements such that for each and every element of one set, there is exactly one element of another set, with no duplication in either set.

Making an adjunct list is a way to organize information from the clues associated with a logic matrix.

Marking traits with a small symbol is a way to track what you’ve learned from the clues associated with a logic matrix when the number of possibilities has been reduced but the exact correspondence has not yet been discovered.

A way to reveal new correspondences is to substitute known correspondences into the clues.

Sometimes combining two or more clues reveals correspondences.

Cross-correlations use logic to make a connection between two categories based on the connection that each category has with another category. For example, Jane has a red car, the red cars in the lot are sports cars, therefore, Jane has a sports car. Connecting Jane with sports cars is possible because both Jane and sports cars are connected with red cars.

Making an assumption benefits you only if you can prove your assumption is incorrect. The most important part of making an assumption is proving your assumption is incorrect.

P116, 511

A pattern is a coherent rule or characteristic shared by elements of a set. Recognizing a pattern enables you to reduce a complex problem to a pattern and then to use the pattern to solve the problem.

A sequence is an ordered string of numbers tied together by a consistent rule, or set of rules.

A term is an individual member of a sequence.

P146, 152, 510, 511

When using the guess-and-check strategy, you guess an answer and then evaluate it in a systematic way. Organizing the information into a table helps to develop a system for repeating this process with more and more refined guesses until you arrive at the solution.

The guess-and-check strategy is also an attitude. When guessing and checking, you must first believe that you can solve a problem, even if you don’t understand it well on the outset.

Ratings reflect whether the guess is too low or too high.

A mixture problem is a common real-life application problem, in which two or more substances are mixed together to form a new blended substance (chocolate and milk, different colors of paint, sugared and nonsugared cereal) where the substances differ in some characteristic such as tint, concentration, or economic value. A mixture problem can be solved by guess-and-check, subproblems, or algebra.

Guess-and-check is a strategy for solving a problem by making, refining, and keeping track of estimations in an organized chart.

P176, 180

Spatial organization is a problem-solving theme where you organize information spatially. Draw a Diagram, Draw Venn Diagrams (p322)

Organizing information is a problem-solving theme where you arrange information into a table or list. Systematic List, Guess-n-Check, Unit Analysis (p201)

Changing focus is a problem-solving theme where you focus on an interim goal or goals rather than on the whole problem. Subproblems, Working Backwards (p296)

When using the subproblems strategy, you organize your plan of attack. When using the subproblems strategy, you first move your focus away from the main problem you are working with and instead concentrate on achieving one or more subgoals. When you have achieved your subgoals, you can solve the main problem, the overall goal.

Listing subproblems outlines an action plan and focuses your thinking.

P201, 215, 223, 510, 511, 514

Unit analysis is a method of organizing quantitative information that carefully keeps track of units during computation in order to produce the correct quantity (number and unit) in the answer.

Unit conversion is a method of changing units by canceling, or multiplying by a one-n-o with the original unit in the denominator and a different unit in the numerator.

One-n-o is a fraction that equals one and is used in converting units. For example .

Unit pricing is the practice of many stores to give prices in terms of one ounce or one of some other appropriate quantity.

The reciprocal of a number is the multiplicative inverse of a fraction, which means the number and its reciprocal multiplied together equal one.

A pipeline is a diagram used to represent unit conversions in which lines connect related units for which a conversion relationship is present.

A manipulative is an object that can be moved or positioned and is used to represent an element of a problem. You can use these objects in unit analysis by writing one-n-o values on one side of an index card with the reciprocal on the reverse side.

The word “per” means “divided by.”

Steps to using unit analysis…

1. Identify all the units in the problem.
2. Consider what units are required in the answer.
3. Establish what unit conversions are needed.
4. Make manipulatives for the given information and for the reciprocals.
5. Use one-n-oes for the conversion of units.
6. Be flexible in organizing the manipulatives and one-n-oes so that the unwanted units will cancel.

P236

List the most common ways to make a problem easier…

1. Use a number instead of a variable.
2. Use a smaller or easier number in place of a more difficult one in order to develop the process for solving the problem.
3. Do a set of specific easier problems and look for a pattern.
4. Do a specific easier example and figure out an easier process that will work to solve the problem.
5. Change, fix, or get rid of some conditions.
6. Eliminate unnecessary information.

P296, 303, 306, 514

Working backwards requires you to change your focus and consider the whole problem in reverse.

The working backwards strategy is very useful for planning schedules or agendas.

Working “up the page” is sometimes the best way to solve a problem.

A diagram helps you visualize working with fractions in reverse.

Working backwards is a strategy for solving a problem by reversing the steps of a process.

P322, 323, 508, 510, 512, 514

A set is a collection of particular things. Each individual thing in a set is called a member or an element.

A subset is a set contained within a set.

A set is composed of one or more elements, except an empty or null set, which has zero elements.

In a venn diagram, all the characteristics of an outer loop apply to everything within that loop, including other loops.

Disjoint sets are sets that have no elements in common.

The universal set in a give problem is the set of all possible elements.

A venn diagram is a diagram with bounded regions where each region contains elements that share a characteristic.

In a venn diagram, the intersection of two or more distinct sets creates a set that has characteristics of all of the intersecting distinct sets. Intersection is also referred to as overlapping.

P368, 369, 507, 509, 514

Diagrams help you visualize a problem and set up an equation.

Algebra is a language that can help you organize and communicate information. It reaches its peak power when it is used in conjunction with complementary tools, such as the problem-solving strategies covered in the text.

When you move from guess-and-check to algebra to solve a problem, you use exactly the same operations as you did in the guess-and-check version, but you use a variable instead of a specific number to represent the unknown quantity you were trying to guess. A guess-and-check chart shows relationships and operations that often lead to an equation.

Algebra is a strategy for solving a problem using variables and equations. A variable is an unknown quantity in a problem. An equation is a mathematical statement asserting the equality of two expressions. An expression is an algebraic quantity.