



# Problem Solving Pathway

by Ashley C. Fernandes

## General Description:

A self-learning guide, teaching the art of problem solving.

The initial books use puzzles and games, as tools to teach fundamental skills and concepts.

Later books apply the tools and skills learned, to real world situations.

Each self-contained book teaches a separate set of concepts. The problem solving apprentice is advised to sequentially follow the learning pathway, the expert can enhance specific problem solving concepts.

## Intended Audience:

- Anyone needing analysis, problem solving, decision making, skills.
- College-level students, NEET's (Not in Education, Employment, Training), the employed.

## The problem solving angle:

Each puzzle/game (in the initial four books) is considered a problem to be solved.

Problem solving phases – identification of the problem, ignoring redundant and irrelevant information, analysis, getting wrong or sub-optimal solutions, zeroing in on the optimal solution (deciding), implementing the solution, reviewing your solution (seeking user and stakeholder feedback), re-implementing a better solution (process improvement).

Most puzzles can be solved in only one way.

There are many strategies for winning games. If winning is impractical, sue for a draw.

Real world problems usually have several strategies and several ways of solving them.

To find the optimal solution, you must first find all possible solutions.

A good solution demands you spend time analyzing the problem (or waste time in rework).

The solution finally implemented will depend not only on its feasibility (suitability for purpose), but also on the convenience it provides to all its stakeholders (decision makers, implementers, people who are going to use it daily).

## Details:

Each puzzle or game or real world problem must first be understood. Unless you know and understand what you seek, how will you know when you have found it?

Problem solving is 90+% analysis. Proper analysis in the beginning prevents rework at later critical stages, when time cannot be spent doing rework or correcting deficient analysis.

Find viable solution paths, abandon impossible solution paths.

Find which viable solution paths give solutions you can *live with*.

Implement each solution; find which is the optimal one *under current circumstances*.

Seek feedback to improve the current solution, or to seek a better solution.

## Technical details:

Name of author: **Ashley C. Fernandes.**

Type of publication: **Independent.**

Feedback/suggestions/comments:

**info@problemsolvingpathway.com**

Output: PDF file, Amazon Kindle file.

With enough demand, a printed book (PoD or offset).

**Twelve books, 128 pages each** (page size 6" x 9") per book, inclusive of Title, Copyright, Contents...

Genre: life-skills, 'How To', self-help, self-learning, education, training.

Status: The first seven books will be available in January 2018.

Books typeset and illustrated in software called LaTeX.



# *Problem Solving Pathway*

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## **Synopsis (Books I – IV): Problem solving basics, with fun activities (puzzles & games).**

The series starts from the ground-up. Each ‘simple’ puzzle is backed by detailed analysis and a lot of insight. Each problem references concepts learned in previous problems.

Gradually, ‘puzzles’ morph into ‘problems’. You now need insights gained from solving the previous puzzles, and a dogged determination to find solutions. The brain is cajoled into analyzing minor details, seeking multiple solutions, deciding the optimal solution (as demanded by the problem statement and the current ground realities).

Excelling at puzzles and games will not help you to solve real life problems in any direct way. They are merely tools that will indirectly help you to develop your analytical ability, explore your thinking and reasoning powers, enhance your powers of observation, cultivate your decision-making abilities. You will use the idea behind the tools, to solve real world problems.

### **Book I: Puzzles & Patterns**

A starting point for the novice, on their problem solving journey. A foundation book that will even help the expert, with its detailed analysis, deep insights, astute observations.

Foundation concepts of analysis and investigation are explained using simple puzzles, identifying patterns and connections, basic mathematics.

### **Book II: Shapes & Contours**

An advanced step on the problem solving journey, for those who have mastered the foundation principles and tools of problem solving.

Shapes are explored chiefly using coin and matchstick puzzles. The reader will learn how to explore all solution pathways, identify those that lead to solutions.

### **Book III: Games & Thinking**

Logical thinking is explored in the guise of parlor games, riddles, and language puzzles.

The reader will learn how to define victory, strategies to avoid defeat, how to out-think your opponent, sue for a draw when outclassed by an opponent, eliminate impossible problem paths. Games naturally lead on to logical thinking that unravels convoluted puzzles. Lateral and creative thinking take over when logic fails.

### **Book IV: Testing, Testing**

Go mad exploring these conundrums! The expert problem solver will gain fresh insights and understanding of familiar tools and concepts.

This book evaluates how much your problem solving skills have matured. Each problem adds a twist, gives fresh insight to familiar tools and concepts.



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## **Puzzles and games are used to illustrate these tools:**

1. Teaching must start simple, to ease the path to (complex) real world problem solving
  - Defining the tools and nomenclature used throughout the book series
  - Puzzles children solve: Illusions, find hidden objects, spot differences in pictures, jigsaw puzzles
  - Slightly more advanced puzzles: Crossword, Word search
2. Finding patterns and making connections
  - Find missing numbers and pictures, complete or extend patterns
  - Identifying what is strongly associated, weakly associated, not associated, with a pattern

## Basic mathematics

- Finding single unknowns, multiple unknowns and simultaneous equations
  - Geometry and picture problems
  - Tricky problems
3. Shapes
    - Identifying basic shapes
    - Counting simple and composite shapes
    - Positioning. Manipulating, combining shapes, tanagrams
  4. Matchstick puzzles
    - Manipulating shapes (changing, adding, destroying) by moving matches
    - Changing size and type of (simple or composite) shapes – squares and triangles
    - Mathematics using digital numbers and Roman Numerals
  5. Coin puzzles
    - Moving coins in cells or in a grid, using constraints
  6. Games
    - Sudoku, Solitaire, Minesweeper, Rubik's cube, chess, draughts
    - Plot a winning strategy, or a draw when a win is unlikely or impossible, avoid defeat
    - Efficient moves and completing the game successfully
  7. Thinking
    - Logical, lateral, creative, thinking
    - Methods to enhance lateral, creative, and abstract, thinking
  8. Weighing and measuring problems
    - Solids and liquids
    - Efficient methods taking the least time, involving the least resources or resource waste



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## **Synopsis (Books V – VII): Real world problem solving.**

These books outline the ‘theory’ and practical insight into real world problems, suggesting tools and concepts used to solve them. Each real world problem is unique, each person has their own criteria of what constitutes an ‘acceptable’ solution. The contents are more in terms of guidelines rather than rules, recommendations on how you need to tackle and solve real world problems.

While you do not need to understand puzzles and games to solve real life problems, knowledge of their inner working is beneficial to understanding the real world tools you need: analysis, thinking and questioning, observation and reasoning powers, decision-making.

## **Book V: Real World Tools**

Real world problems need real world tools: Thinking (logically, laterally, creatively), questioning, using the senses and paying attention to relevant detail, remembering, (English) language and communication skills, time management, teamwork and crowdsourcing, intuition, judging and deciding, diagrams as visual tools.

## **Book VI: Along The Pathway**

Defining the problem solving process, explaining the obstacles to problem solving, tips and tricks to solve problems effectively and efficiently.

## **Book VII: Case Studies**

The real world has a myriad of problems, each with its unique characteristics. It is likely you will come across a problem for which no precedent has been set. Real world stories and case studies come to the rescue, illustrating families of problems, with common characteristics, and commonsense ways of analyzing them.

Taking each story or case study apart and examining their inner working in minor detail, will clue the expert problem solver on how to tackle any generic problem.

Ultimately, your problems belong to you. You own the problems, you own the solutions (and any accolades or brickbats associated with them). You can ask for advice and even help to analyze, solve, implement solutions. But the (positive or negative) consequences of any implementation will belong to you. Understanding foreseen consequences and anticipating and preparing for unforeseen (but likely) negative consequences, are factors that will affect your final decision on which solution is the best one to implement *under the current set of circumstances*.



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## **Tools used in the last three books (real world tools):**

1. Real world problem solving demands real world tools
  - Pseudo-real situations that transit between the puzzle world and the real world
  - Exploring all kinds of thinking – logical, lateral, creative
  - Questioning
  - Using all the five senses to pick up all the information; filtering (paying attention to relevant detail)
  - Memory and aids to recall – do not remember information that is transient, can be easily referenced, is rarely needed, irrelevant
  - (English) language and communication skills, effective messaging and ways to avoid miscommunication
  - Time management – identify tasks not needing undivided attention, how to multi-task
  - Working independently, working in a group or team, crowdsourcing
  - Intuition comes with experience and expertise
  - Educated guesswork – no guessing at random, hoping against hope
  - Judging is the process, deciding is the outcome of the (judging) process
  - Diagrams as visual tools to help simplify and solve complex problems
2. Problem solving has its share of glitches
  - Obstacles to problem solving by way of human emotional weaknesses to flaws, under- and over-analyzing, analysis paralysis, decision paralysis
  - How to ace the problem solving process – tips and tricks to solve problems effectively and efficiently
3. Stories and Case Studies
  - Each real world problem tends to have unique characteristics
  - Short stories and long case studies illustrate salient patterns and similarities, tools that can be used to solve a similar family of problems
  - Guidelines are offered, to help you judge what steps to take when confronted by your very own (unique) problem

# *Problem Solving Pathway*

## More information about the book series

### Goals for the book series

- Self-learn analysis, problem solving, decision making, skills
- Make learning problem solving,
  - A fun activity and not a chore
  - Easy to understand, for anyone with high school education
  - Memorable, to remember how to use the tools in real life situations
- Initial books use puzzles and games to make a drab subject fun
- Later books apply learning from puzzles and games, to real world problems

### Cost of the books

- Around USD 7 per book (print on demand)
- Around USD 5 per book (offset printing, if demand exists)
- Shipping, at actual cost

### These are not ‘puzzle’ books!

- These books focus on problem solving. Period.
- Puzzles and games are merely tools to help on your problem solving quest
- A puzzle solver would rush to find any kind of ‘answer’
- The problem solver will find all solutions; apply analysis and insight to the next problem

### The books are difficult to understand!

- This is not a ‘weekend’ book, or a book to skim through for nuggets of information
- Book I starts simple, with problems children solve! But the analysis is no child’s play
- The expert problem solver can skip Book I, the novice is advised to start at the beginning
- Trying out the problems and understanding them will take time and effort
- The problems are easy to understand, with basic high school education
- Problems gradually get complex (not difficult!) as you progress on the problem solving pathway
- Skip the initial problems, and you may get lost in later analysis
- Books are detail and analysis heavy – so *anyone* can understand without need of an instructor
- Follow the Problem Solving Pathway, to benefit from the insight it offers!

### Who am I?

- A graduate in Electronics and Information Management, I live in Mumbai, India
- Worked in IT infrastructure and operations
- Worked in pre-publishing large print books for learning and vision challenged individuals
- Worked in typesetting of mathematical books and financial booklets for offset printing
- Freelance typesetter for mathematical content (books, articles, papers, slideshows)
  - LaTeX software used for typesetting all content, illustrating all diagrams and figures
  - Since July 2015, working with professors at Massachusetts Institute of Technology
  - Typeset and illustrated ‘Introduction to Linear Algebra, 5<sup>th</sup> Edition’ (ISBN 9780980232776)
  - Typesetting and illustrating ‘Linear Algebra and Learning from Data (available 2018)
  - Both books written and published by Professor Gilbert Strang (gs@math.mit.edu)

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**Please send feedback/suggestions/comments: [info@problemsolvingpathway.com](mailto:info@problemsolvingpathway.com)**