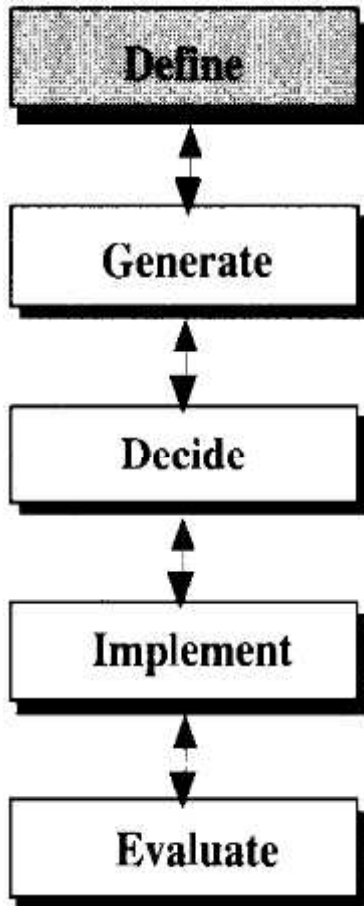


Recap

- Case Studies
- Heuristic (CH#2)
- Paradigm shift
- Effective/Ineffective people



Chapter 3



Problem Definition



Four Steps

1. Collect and analyze information and data.
2. Talk with people familiar with the problem.
3. If at all possible, view the problem first hand.
4. Confirm all findings.

Collect and Analyze Information and Data

- Learn maximum about problem
- Determine what information is missing
- Determine what information is irrelevant
- Properly organize Information
- Make sketches/Drawing where needed
- Analyze trends by making graphs

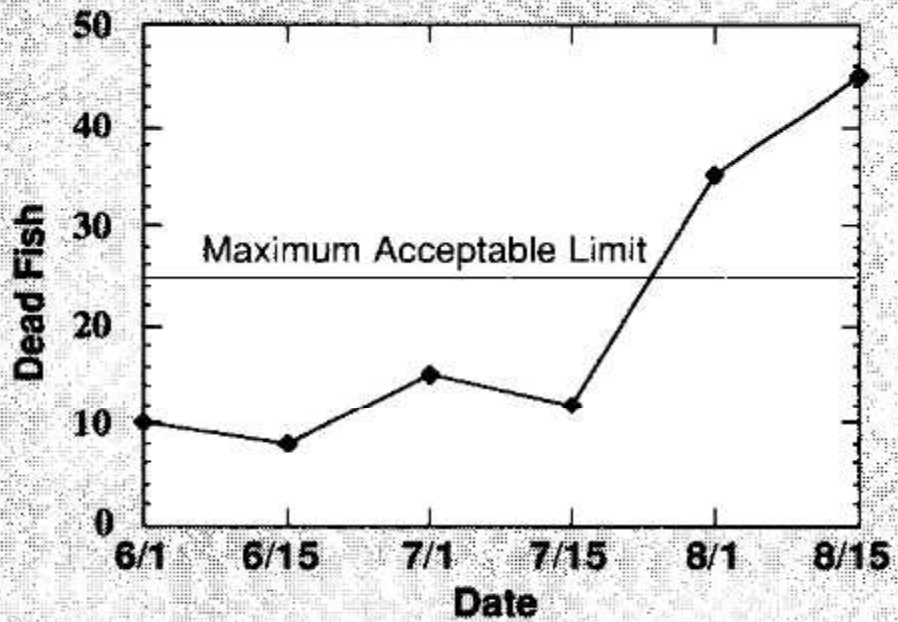
Dead Fish

(Case Study)

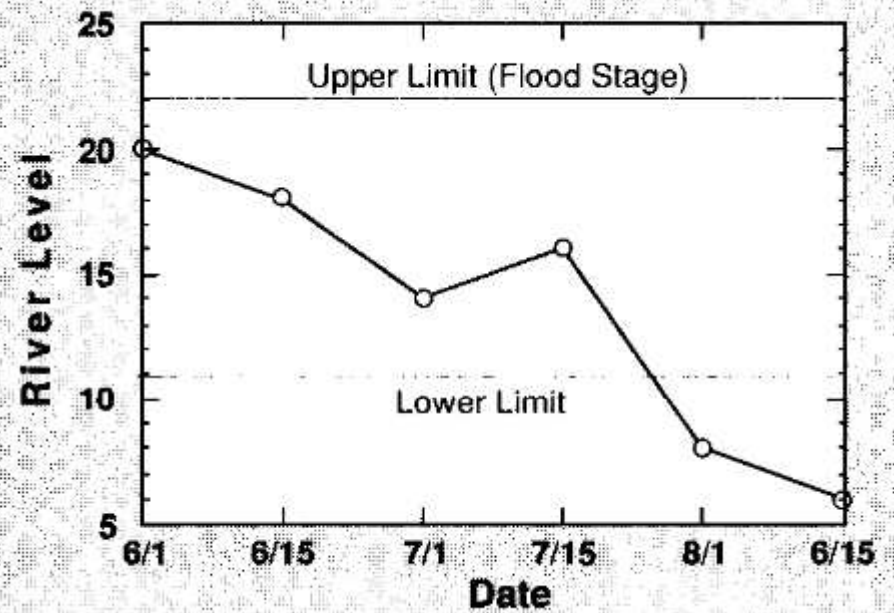
- Chemical Plant discharges its waste in river
- In recent months high rate of fish death is reported

??.....??

NUMBER OF DEAD FISH EACH DAY



RIVER LEVEL EACH DAY



Talk with People Familiar with problem

- Looking past the obvious
- Challenging the basic premises
- Ask for clarification when you don't understand

Seemingly dumb question produce good results

“Non experts are also source of creative solutions”

Seeking Advice

(Case Study)

- Shortage of Elevators capacity

Brainstorming

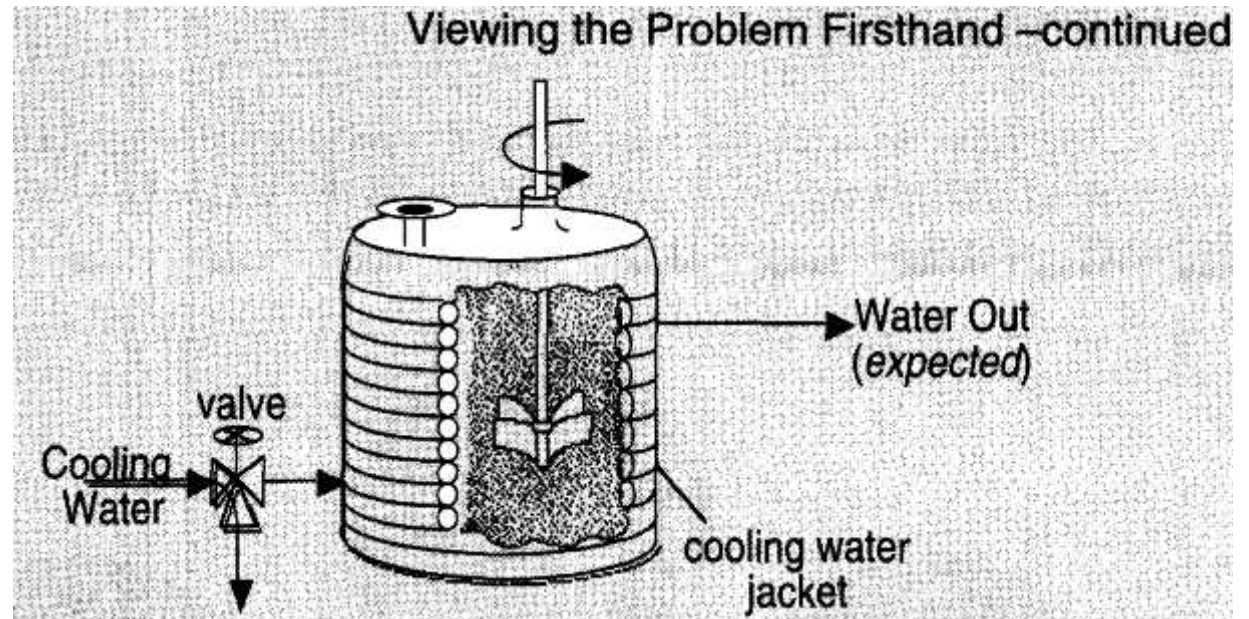
- ★ Manager and assistant manager
- ★ Alternatives
- ★ New elevator inside the hotel
- ★ New shaft is required
- ★ Rooms have to be replaced

Doorman's Interruption



View the Problem First Hand

- Not only talk to people also
- Examine the problem yourself



Confirm all Key Findings

- Verify the collected information
- Cross check and verify
- Eliminate biases and misrepresentation
- Distinguish between fact and opinion



Confirm all Key Findings

(Case Study)

Boxright



Courtland

@ Boxright bought equipment from Courtland

@ It didn't work

@ Boxright decided to Sue Courtland

@ Courtland claimed that Boxright unable to use equipment properly

@ Author of this book Proved Courtland's claim wrong by verifying
Information

Four Steps

(covered)

1. Collect and analyze information and data.
2. Talk with people familiar with the problem.
3. If at all possible, view the problem first hand.
4. Confirm all findings.

Defining the Real Problem



Problem Definition Techniques

- 1 Finding out where the problem came from
- 2 Exploring the problem
- 3 Present State, Desired state and Duncker Diagram
- 4 Statement Restatement
- 5 Kepner Tregoe Problem Analysis

1. Finding out where the problem came from

Find out where the problem statement came from.

- Where did the problem originate?
- Who posed the problem statement in the first place, your supervisor, his/her supervisor, a colleague in your project group, or someone else?
- Can that person explain the reasoning as to how they arrived at that particular problem statement?
- Are the reasoning and assumptions valid?
- Has that person considered the situation from a number of different viewpoints before arriving at the final problem statement?
- Have you used *the first four steps* to gather information about the problem?

Case of Dead Fish

(Revisited)

- Stan Wilson is an engineer

Supervisor's Instructions

- Construct new treatment plant to reduce toxic waste

who posed the problem?

Can reasons arriving at problem statement be explained?

Are the assumptions and reasoning valid?

Has sufficient information/data collected?

How he himself investigated? Next

Sweet and Sour

1. If Tom, who was the piping expert, had asked the head office to explain why they wanted to install piping resistant to sour gas for *this* well, or,
2. If Tom had challenged their reasoning by asking what evidence they had that *this* well produced sour gas, or
3. If Tom had gathered more information by tracking down the laboratory results to learn how much sour gas was in the natural gas?

If Tom had traced back the original source of the product to find out **where the problem came from**, this waste could have been eliminated.



Treat Symptoms only when solving real
problem is impossible or impractical

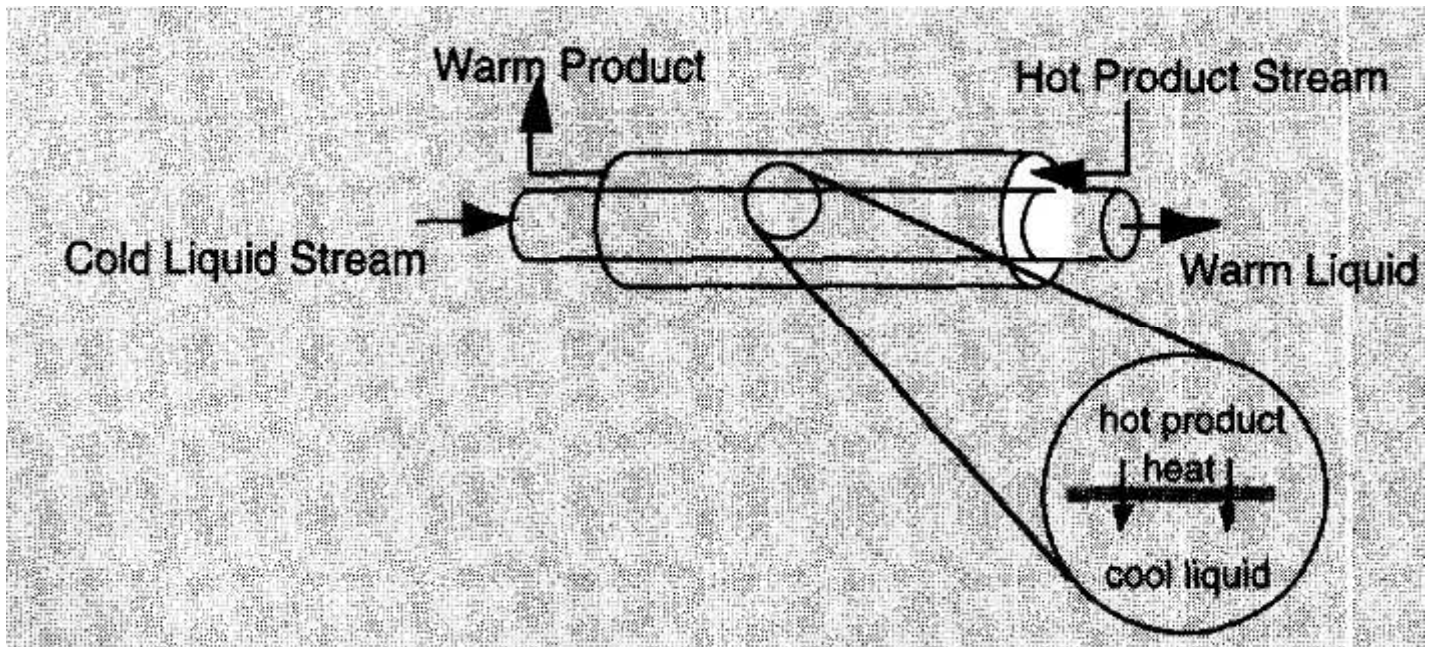
2. Exploring the problem

- 1. Identify All Available Information.**
- 2. Recall or Learn Pertinent Theories and Fundamentals.**
- 3. Collect Missing Information.**
- 4. Solve a Simplified Version of the Problem to Obtain a “Ballpark” Answer.**
- 5. Hypothesize and Visualize What Could Be Wrong with the Current Situation.**
- 6. Brainstorm to Guess the Answer.**
- 7. Recall Past or Related Problems and Experiences.**

- 8. Describe or Sketch the Solution in a Qualitative Manner or Sketch Out a Pathway That Will Lead to the Solution.**
- 9. Collect More Data and Information.**
- 10. After Using Some or All of the Activities Above, Write a Concise Statement Defining the Real Problem.**

De-bottlenecking a Process

1. **Identify inputs/outputs:** Cold liquid stream not cooling hot product stream.
2. **Recall related theories and fundamentals:** The rate of cooling between the two streams is related to the temperature difference between the two streams, their flow rates, and the materials and condition of the unit.
3. **Collect missing information:** What is the size of the current refrigeration unit? What are the entering and exiting temperatures of the liquid streams?
4. **Carry out an order of magnitude calculation:** AH HA! The new unit need be no larger than the old one.
5. **Hypothesize and visualize what could be wrong with the current system:** Inefficient operation of current system? Could something be increasing the resistance to heat transfer (i.e., insulating)?
6. **Guess the result:** Could scale (minerals deposited from the liquid) have built up on the inside of the unit acting as an insulating blanket?



7. **Recall past problems, theories, or related experiences:** Scale greatly reduces the efficiency of the unit.
8. **Sketch solution or solution pathway:** Examine the unit for evidence of scale or fouling that may be reducing the heat transfer efficiency.
9. **Collect more data:** An examination of the heat exchanger showed it was indeed badly fouled.
10. **Define the real problem:** The scale on the pipe wall must be removed in order to cool the product stream effectively.

3. Using Present State/Desired State Technique

The Situation: During WWII, a number of aircraft were shot down while engaging in bombing missions over Germany. Many of the planes that made it back safely to base were riddled with bullet and projectile holes. The damaged areas were similar on each plane.

The instructions given to solve the perceived problem: *“Reinforce these damaged areas with thicker armor plating.”*

Present State

Many bullets/projectiles penetrating aircraft.

Desired State

Fewer planes being shot down.

Present State

Many bullets/projectiles penetrating aircraft.

Desired State

Fewer bullet holes.

Present State

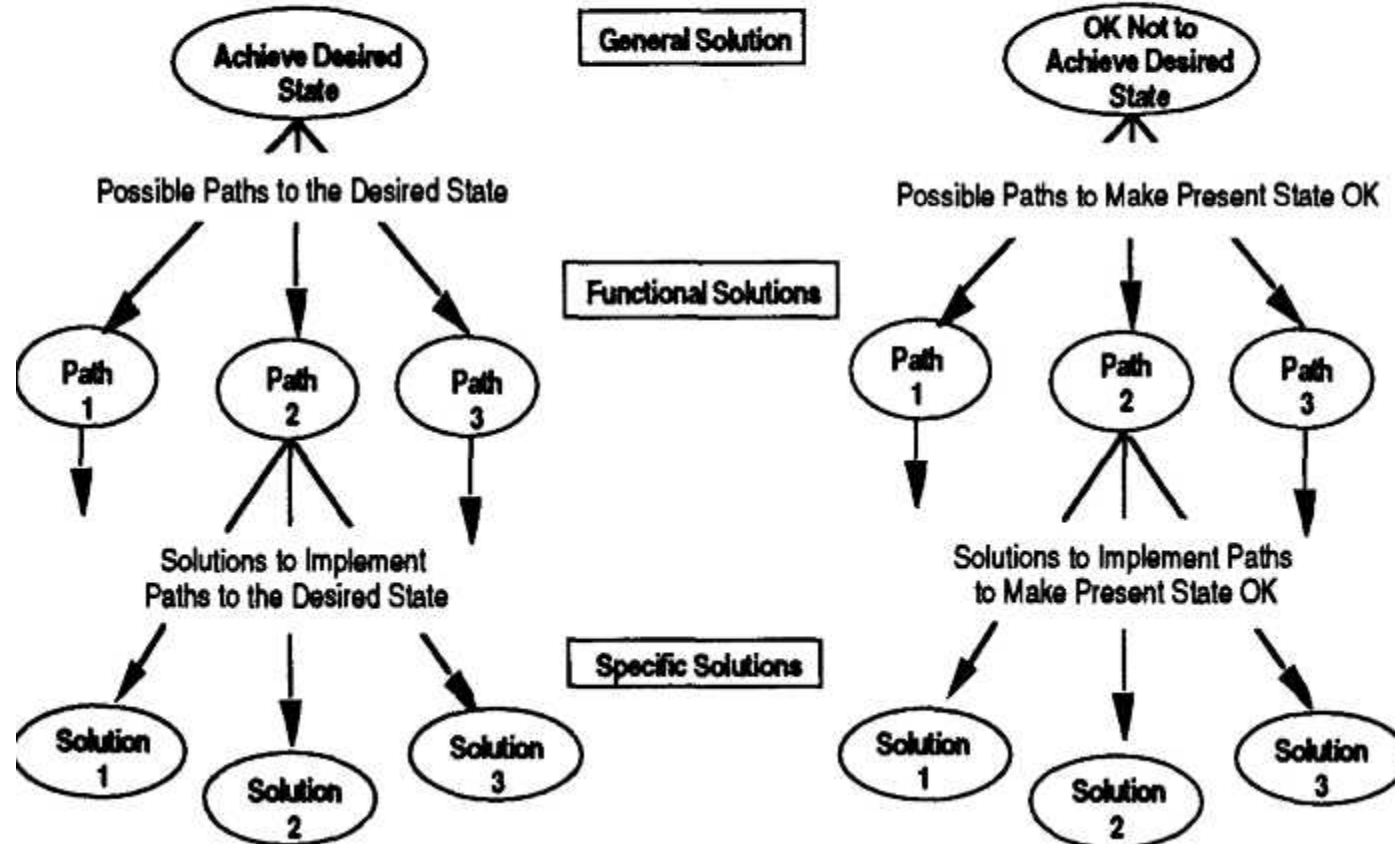
Many bullets/projectiles penetrating aircraft in critical and noncritical areas.

Desired State

Fewer bullets/projectiles penetrating critical areas.

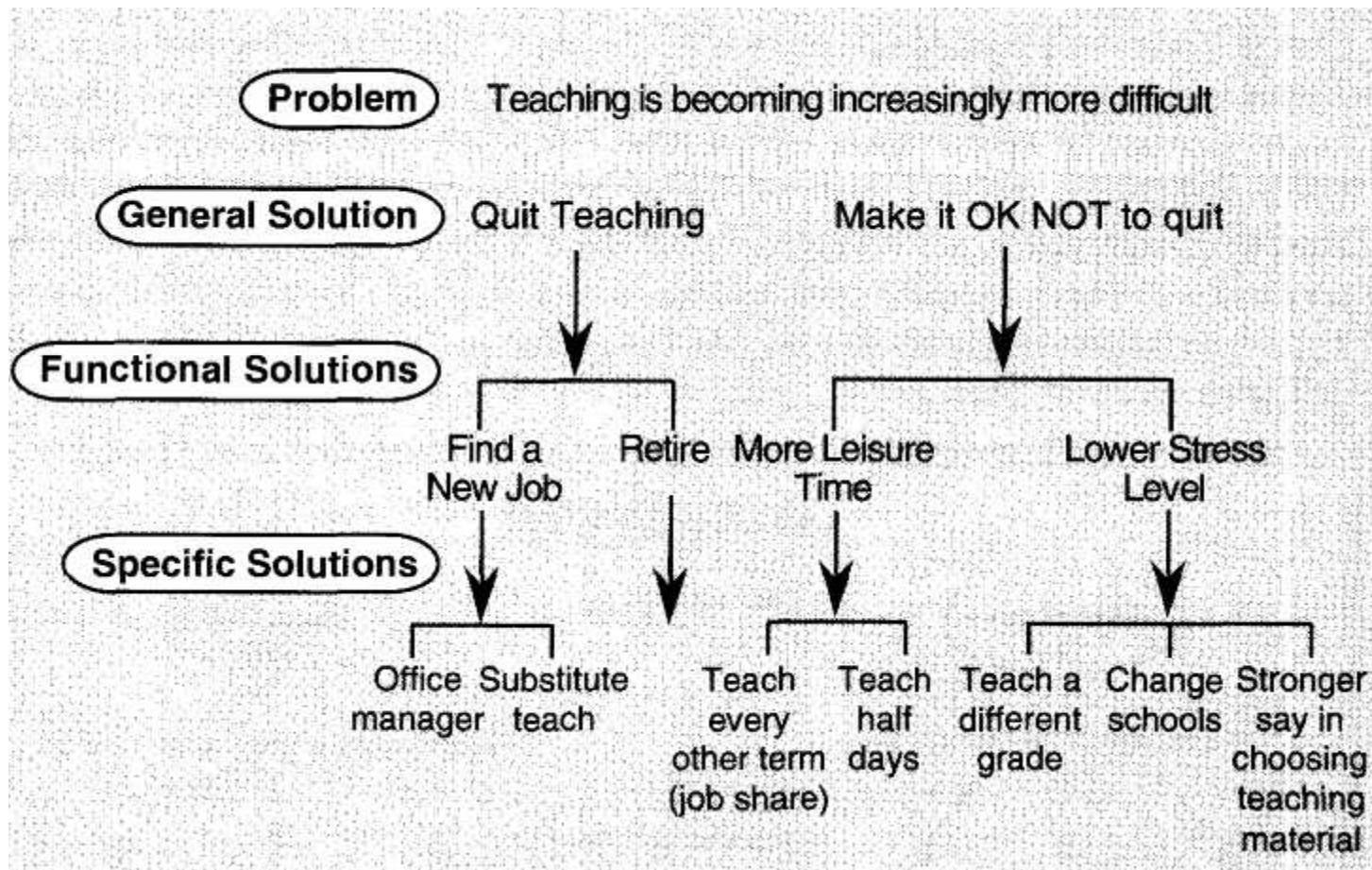
The Duncker Diagram

Duncker Diagram



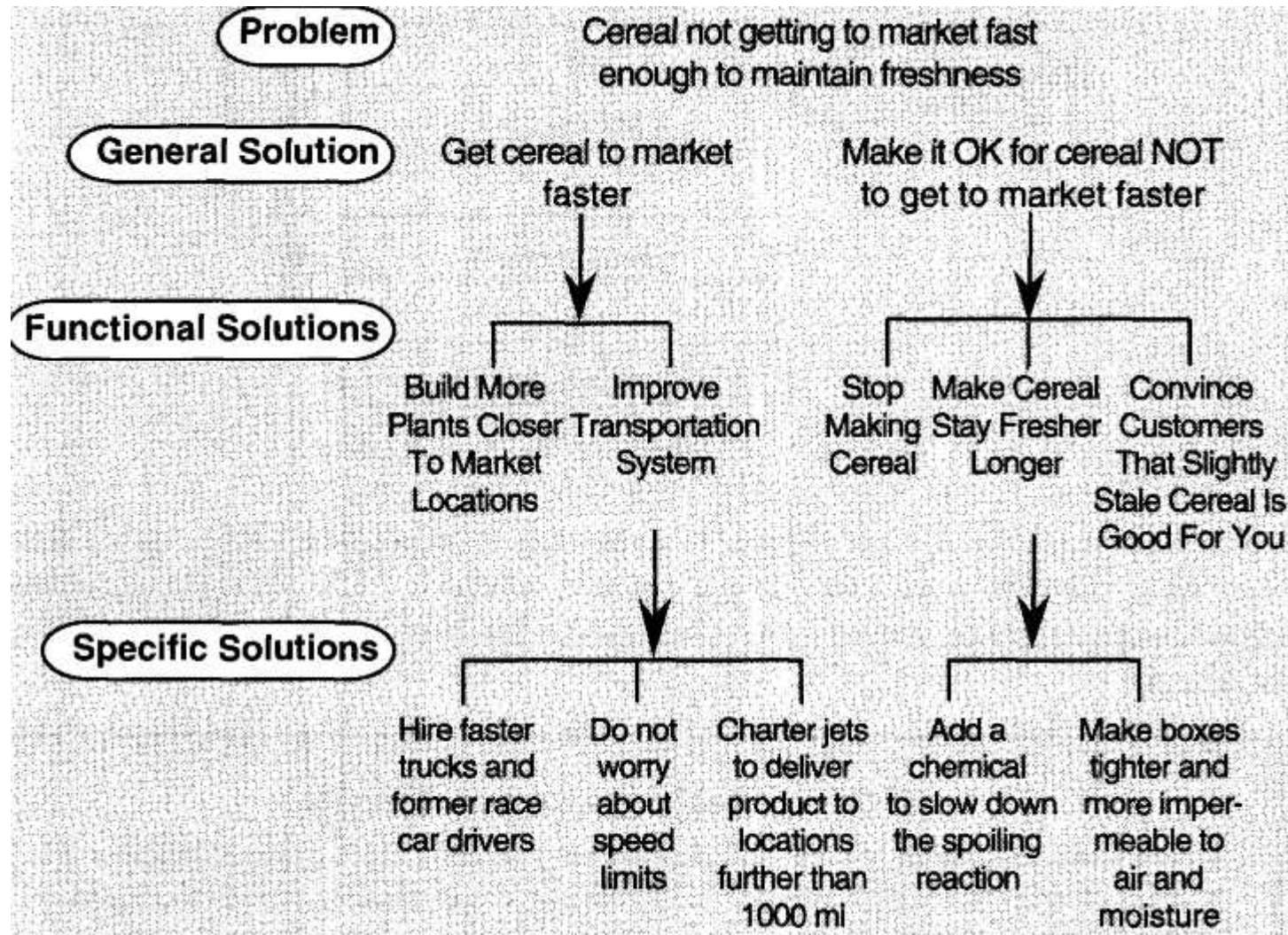
Kindergarten Cop

(Case Study)



TO Market, TO Market

(Case Study)



4.Statement Re-statement

1. Vary the stress pattern—try placing emphasis on different words and phrases.
2. Choose a term that has an explicit definition and substitute the explicit definition in each place that the term appears.
3. Make an opposite statement, change positives to negatives, and vice versa.
4. Change “every” to “some,” “always” to “sometimes,” “sometimes” to “never,” and vice versa.
5. Replace “persuasive words” in the problem statement such as “obviously,” “clearly,” and “certainly” with the argument it is supposed to be replacing.
6. Express words in the form of an equation or picture, and vice versa.