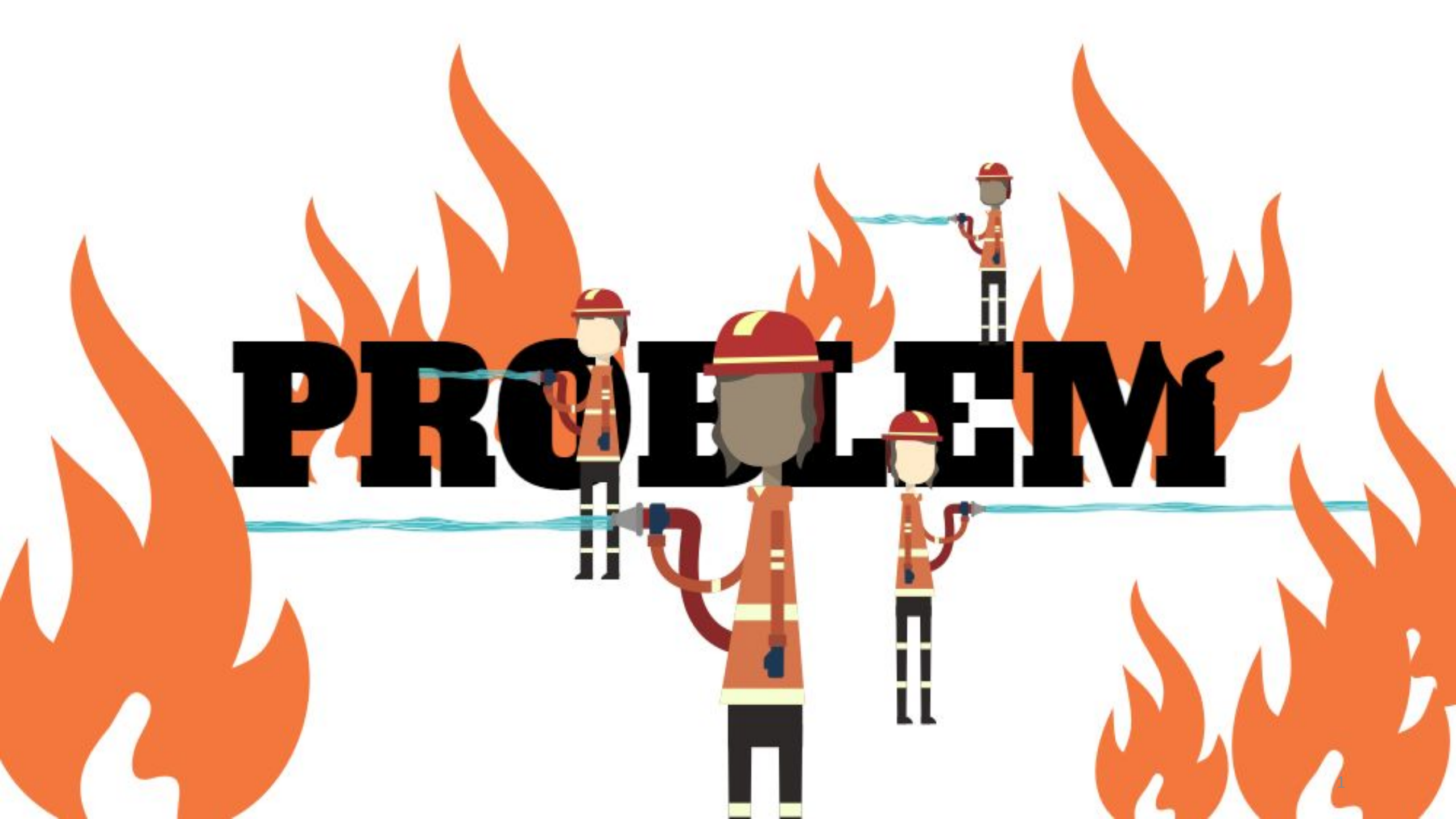
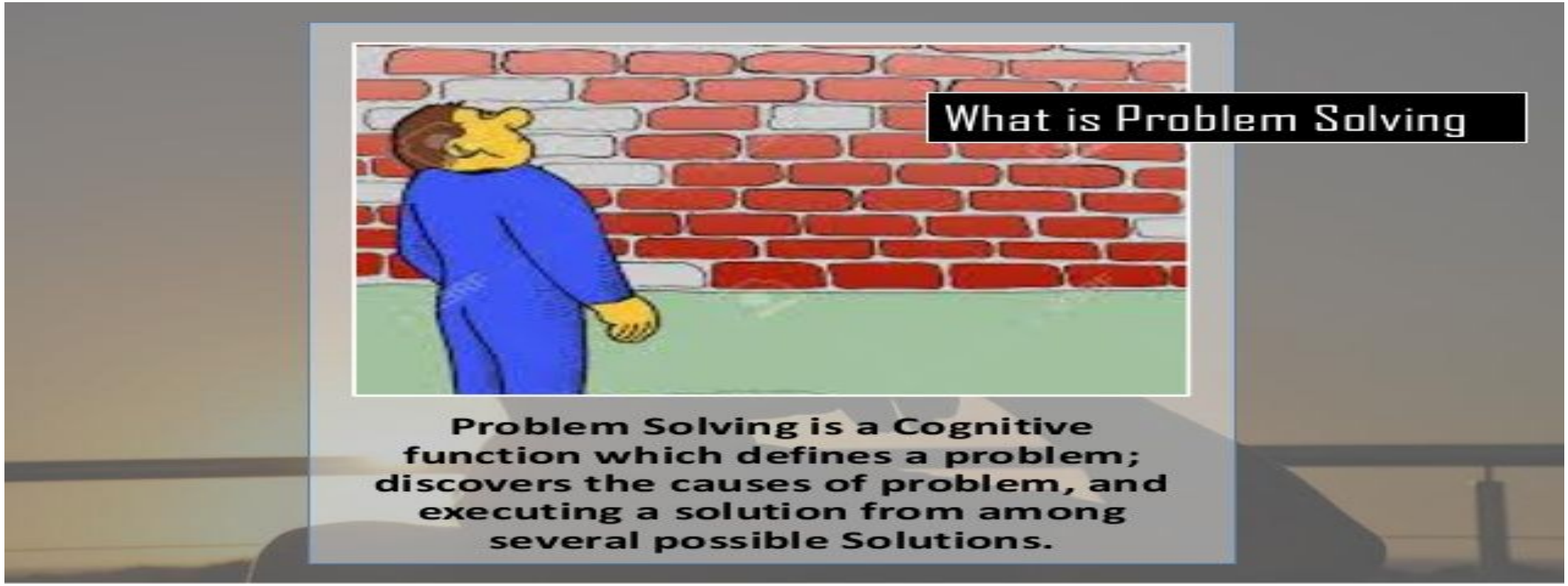

PROBLEM

Problem Solving

- A problem occurs when there is an obstacle between a present state and a goal, and it is not immediately obvious how to get around the obstacle.



- (9 +43 - 4) ÷24 – 4
- (8 + 3) + (8 +16 ÷ 4)
- X in an algebraic equation, and
- calculating the trajectory of a rocket's flight

- Determining what really happened during the ‘Demolition of the Babri Masjid’
- Suggesting measures to address the current environmental issues.
- Predicting how to dispose of nuclear waste safely.

- Well-defined problems usually have a correct answer; certain procedures, when applied correctly, will lead to a solution.

- Ill-defined problems, which occur frequently in everyday life, do not necessarily have one “correct” answer, and the path to their solution is often unclear.

Ill-Defined

Given state is not clearly specified , unclear goal state, unclear set of allowable procedures and multiple solutions

For example: How should we resolve global warming?

Argumentation, attitudes and "metacognition highly predicted problem-solving score[

Well-Defined

Given state is clearly specified, there are clearly specified goals, clearly specified set of allowable procedures and one clear solution

For example: 5x=10

Domain knowledge and justification skills highly predicted problem-solving scores

- Problem solving is a “higher –order cognitive process that requires the modulation and control of more routine or fundamental skills”(Goldstein & Levin,1987)

- Everyday we solve a number of problems ranging from simple to complex. Some problems take little time whereas some take much time to solve. We look for alternative solutions if do not get the right kind of resources to solve the problem in hand.

1. Problem identification: Do we actually have a problem?

2. Problem definition and representation: What exactly is our problem?

3. Strategy formulation: How can we solve the problem?

The strategy may involve analysis—breaking down the whole of a complex problem into manageable elements. Instead, or perhaps in addition, it may involve the complementary process of synthesis—putting together various elements to arrange them into something useful.

Another pair of complementary strategies involves divergent and convergent thinking. In divergent thinking, you try to generate a diverse assortment of possible alternative solutions to a problem. Once you have considered a variety of possibilities, however, you must engage in convergent thinking to narrow down the multiple possibilities to converge on a single best answer.

4. Organization of information: How do the various pieces of information in the problem fit together?

5. Resource allocation: How much time, effort, money, etc., should I put into this problem?

6. Monitoring: Am I on track as I proceed to solve the problem?

7. Evaluation: Did I solve the problem correctly?

- Problem identification
- Problem definition and representation
- Strategy formulation
- Organization of information
- Resource allocation
- Monitoring
- Evaluation

Classic Problems and General Methods to Solution

- GENERATE AND-TEST TECHNIQUE – generating possible solutions and then testing them.

- It fails when there are many possibilities and no particular guidance for generation process.

- It can be useful, however, when there aren't a lot of possibilities.

- WORKING BACKWARDS - Analyzes the goal to determine the last step needed to achieve it, then the next-to-the last step and so on.

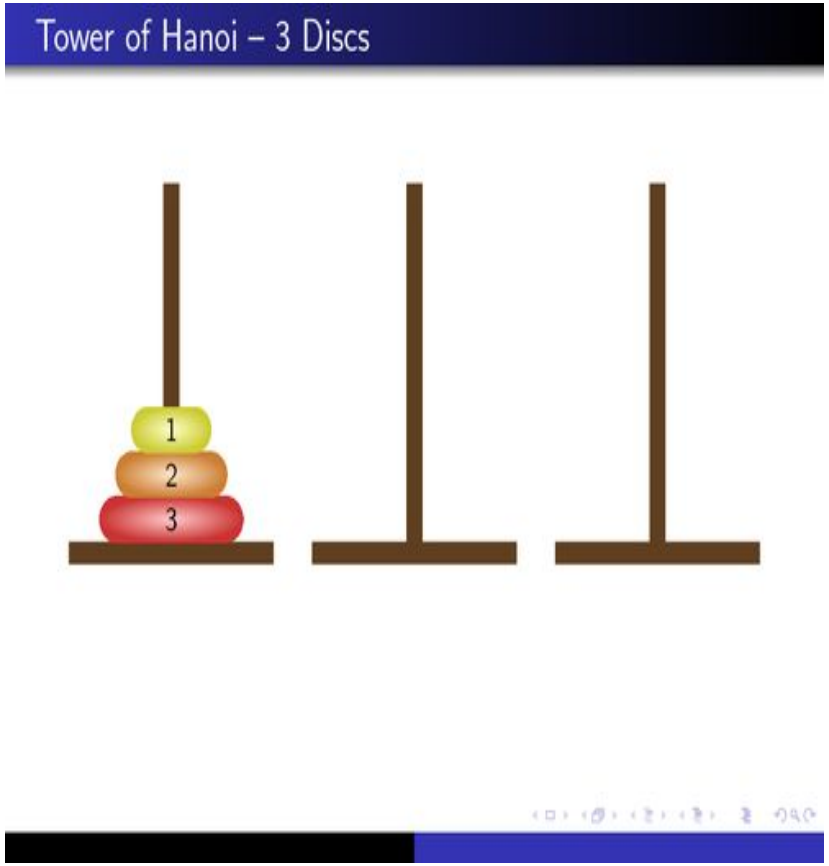
When to use the work backward strategy

- The final result is clear and the initial portion of a problem is obscure.
- A problem proceeds from being complex initially to being simple at the end.
- A direct approach involves a complicated equation.
- A problem involves a sequence of reversible actions.

- MEANS-ENDS ANALYSIS - *goal-based* problem solving, a framework in which the solution of a problem can be described by finding a sequence of *actions* that lead to a desirable goal.
- Create a sub-goal.
- Allows both backward and forward searching
- The MEA technique is a strategy to control search in problem-solving.

Tower of Hanoi Problem

- **Tower of Hanoi problem** as three discs stacked on the left peg, and the goal state as these discs stacked on the right peg. Try solving this problem by following the instructions in the demonstration.
- **1.** Discs are moved one at a time from one peg to another.
- **2.** A disc can be moved only when there are no discs on top of it.
- **3.** A larger disc can never be placed on top of a smaller disc.
- https://www.youtube.com/watch?v=rVPuzFYlfYE



BLOCKS TO PROBLEM SOLVING

- Functional Fixedness - refers to people's tendency to see objects as serving conventional problem-solving functions and thus failing to see possible novel functions.

Figure 7.2 The String Problem
How do you tie the two strings together if you cannot reach them both at the same time?

https://www.youtube.com/watch?v=Uv-KycvzHCA

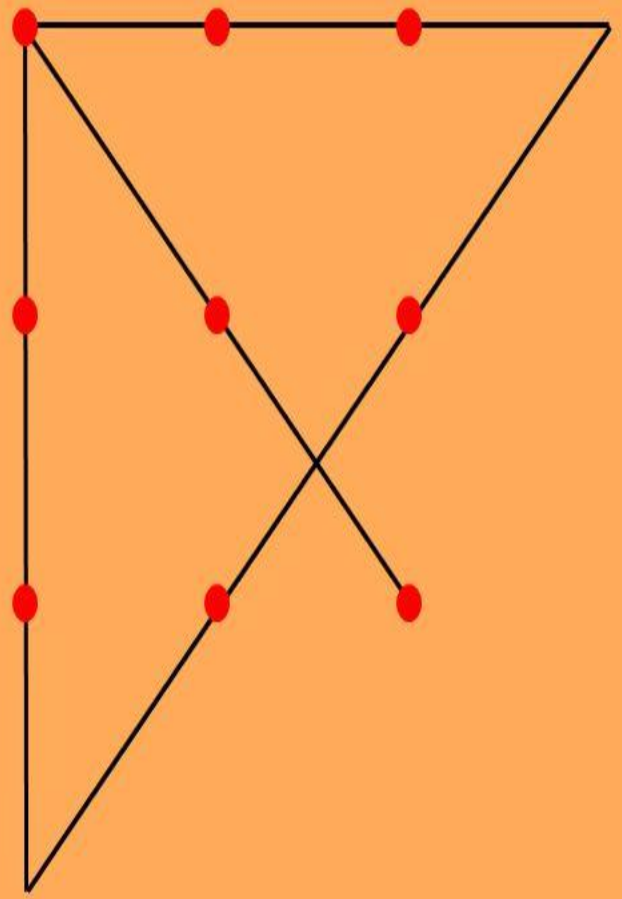
- Mental set is the tendency to adopt a certain framework, strategy, or procedure or, more generally, to see things in a certain way instead of in other, equally plausible ways.

Draw four straight lines that pass through each of the nine dots without removing your pencil from the paper.

Arrange six matches so that they form four triangles with all sides equal to the length of one match.

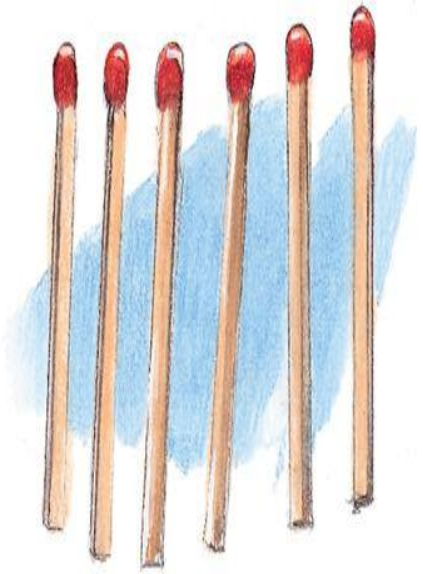
Nine dots mental set

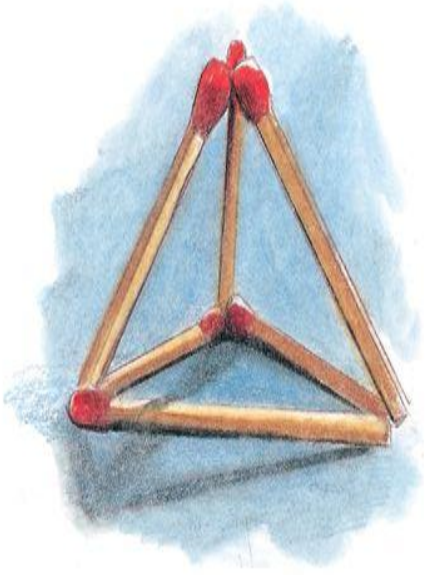
- Most people will not draw lines that extend from the square formed by the nine dots
- To solve the problem, you have to break your mental set



The Matchstick Problem

Our mental set from our past experiences with matchsticks predisposes our arranging them in two dimensions.





To arrange six matches to form four equilateral triangles, you must view the problem from a new perspective.

- Incubation Effects - People often report that after trying to solve a problem and getting nowhere, they can put it aside for hours, days, or weeks and then, upon returning to it, can see the solution quickly.