2.2 Problem Solving: Skills and Approach

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Preview

- In the previous sequence, *problem solving* was defined as a process and problems were divided into different classes.

- In this sequence, *problem solving* skills and approach will be presented.

Problem Solving Skills

- Knowledge.
  - Gained during engineering education.
- Experience.
  - Gained through practical work.
- Learning.
  - Ongoing as new problems require continuous learning.
- Motivation.
  - It is vital for engineers to enjoy their work and be inspired to resolve problems
- Communication.
  - An essential skill that is needed for team work.

Skilled vs. Unskilled Problem Solvers

- Skilled problem solvers differ from unskilled problem solvers in many areas:

    - Approach

    - Knowledge

    - Attack

    - Logic

    - Analysis

    - Perspective

Approach

- Unskilled problem solver is easily discouraged and careless.

- Skilled problem solver is
  - Motivated
  - Persistent
  - Confident
  - Careful.

Knowledge

- Unskilled problem solver does not understand the problem requirements.

- Skilled problem solver
  - Understands the requirements
  - Understands the facts

Attack

- Unskilled problem solver tries to calculate the answer right away.

- Skilled problem solver breaks the problem into pieces.

Logic

- Unskilled problem solver uses guesses and jumps to conclusions quickly.

- Skilled problem solver
  - Uses basic principles.
 - Works logically from step to step .

Analysis

- Unskilled problem solver is uncertain and jumps to unfounded conclusions.

- Skilled problem solver
  - Is organized.
  - Thinks carefully.

Perspective

- Unskilled problem solver can not estimate the answer.

- Skilled problem solver
  - Can estimate the answer.
  - Understand what is important.

Problem Solving Approach

1. Understand.
2. Think.
3. Plan.
4. Execute.
5. Verify.
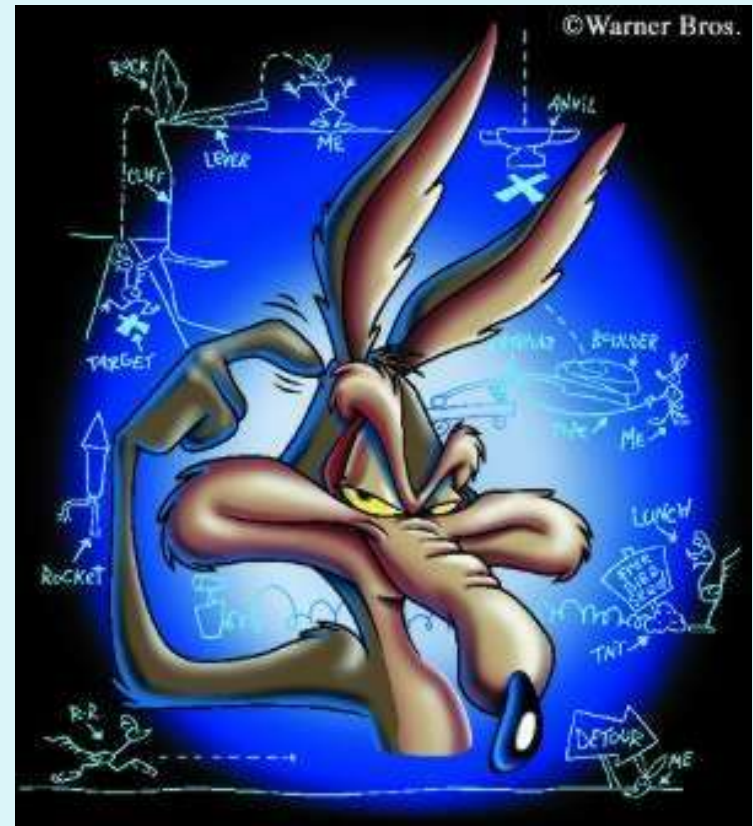
Understand

- The first step toward solving the problem is understand it or to *identify the problem*.

- During students' education, the instructor is usually the one that identifies a particular problem for the students to solve.

- During work, this problem can be identified by the manager , the engineer himself, or another department.

- Example: Although Nokia has the largest share of the mobile phone market, they are losing in the smart phone battle to Blackberry.

Think

- Once the problem has been identified, engineers need to take some time to think about the problem thoroughly.

- This is referred to as *Synthesis*.

- *Synthesis* is creative step in which parts are integrated together to form a whole.

Plan

- Once the problem has been studied, a plan needs to be devised.

- This is done by dissecting the whole problem into pieces.

- This step is referred to as *Analysis*.

- Analysis involves the use of logic to make correct decisions and identify relationship among the parts.

- A key aspect of this step is the use of mathematical models.

- Most of the engineering education focuses on this step.

Execute

- Now that the problem has been studied and analyzed, the plan needs to be executed and solutions need to be developed.

- This is referred to the *Application* of the solution.

- *Application* is the process were appropriate information is identified for the problem in order to solve it.

Verify

- Finally, engineers must check their work and understand all issues involved.

- *Comprehension* is the key here where the proper theory and data is used to solve the problem.

Conclusions

- Skilled problem solvers excel in their approach, knowledge, attack, analysis, and perspective.

- Problem solving approach involves understanding, thinking, planning, executing, and checking.