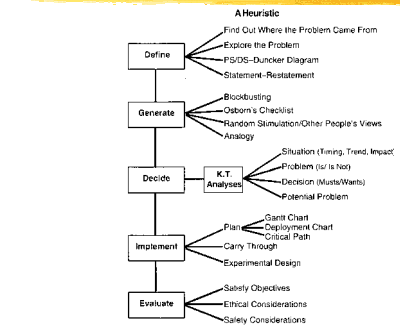
Putting It All Together

- When faced with a problem, bring many principles of different building blocks to bear on the problem at the same time

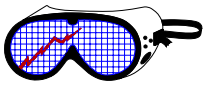
Putting It All Together



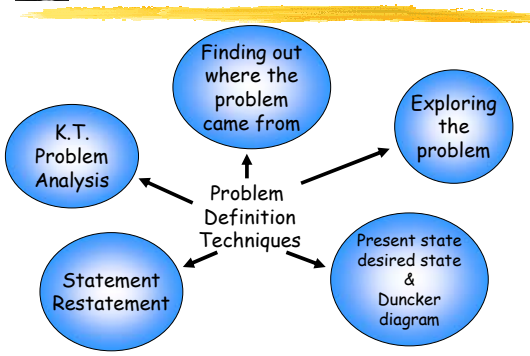
Define the Problem

"Start with an open mind"
"Don't jump to conclusions"

- Collect and analyze information and data
- Talk with people familiar with the problem
- View the problem
- Confirm all findings

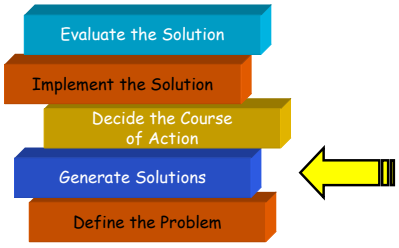


Define the Problem



Generating Solutions

- ***"Nothing is more dangerous than an idea, when it is the only one you have."***



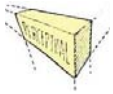
Generating Solutions

- ***"Nothing is more dangerous than an idea, when it is the only one you have."***
- Once you have defined the problem you want to make sure you generate the best solution.
- Many times mental blocks hinder your progress toward a solution.

Recognizing Mental Blocks

- The first step to becoming a better problem solver is to understand what conceptual blocks are and how they interfere with problem solving.
- A conceptual block is a mental wall that prevents the problem solver from correctly perceiving a problem or conceiving its solution.
- The most frequently occurring conceptual blocks are perceptual blocks, emotional blocks, cultural blocks, environmental blocks, intellectual blocks, and expressive blocks.

Recognizing Mental Blocks



Perceptual Blocks

Emotional Blocks 

Cultural Blocks

Environmental Blocks 

Intellectual Blocks

Expressive Blocks 

Osborn's Checklist

- A technique used to generate additional ideas related to those already defined

Osborn's Checklist for Adding New Ideas

Adapt?	How can this idea be used as is? What are other uses it could be adapted to?
Modify?	Change the meaning, material, color, shape, odor, etc.?
Magnify?	Add new ingredient? Make longer, stronger, thicker, higher, etc.?

Osborn's Checklist

Osborn's Checklist for Adding New Ideas

Minify?	Split up? Take something out? Make lighter, lower, shorter, etc
Substitute?	Who else, where else, or what else? Other ingredient, material, or approach?
Rearrange?	Interchange parts? Other patterns, layouts? Transpose cause and effect? Change positives to negatives?
Combine?	Combine parts, units, ideas? Blend? Compromise?

Random Stimulation

- **Random Stimulation** is a technique which is especially useful if we are stuck or in a rut. It is a way of generating totally different ideas than previously considered and can "jump start" the idea generation process and get it out of whatever current rut it may be in.
- Introduce "***weird***" ideas during brainstorming.
- Choose randomly a word from the dictionary. Use that word to generate other words that can simulate the flow of ideas.

Other People's Views (OPV)

- When approaching a problem that involves the thoughts and feelings of others.
- Imagining yourself in the role of the other person allows you to see complications of the problem not considered previously.

Futuring

- Examine the problem carefully to make sure the real problem has been defined.
- Now, imagine yourself at some point in the future after the problem has been solved. What are the benefits of having a solution?
- "Look around" in the future. Try to imagine an ideal solution to the problem at hand without regard to technical feasibility. Remember, in the future, anything is possible.
- Make statements such as: "If only (this) _____ would happen, I could solve...."
- Dare to change the rules! The best solutions to some problems are contrary to conventional wisdom.

Analogy and Cross-fertilization

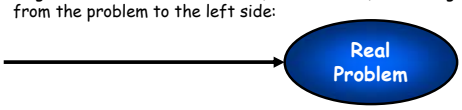
- It is well documented that a number of the most important advances in science, engineering, art, and business come from cross-fertilization and analogies with other disciplines.
- Here ideas, rules, laws, facts, and conventions from one discipline are transferred to another discipline.
- There are four steps you can use to solve problems by analogy:

1) State the problem,
2) Generate analogies (this problem is like trying to. . .),
3) Solve the analogy, and
4) Transfer the solution to the problem.

The Fishbone Diagram

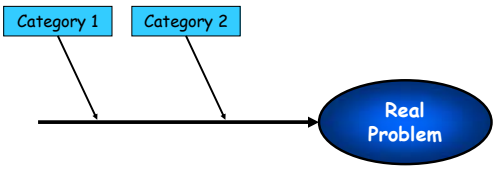
- Fishbone diagrams are a graphical way to organize and record brainstorming ideas. The diagrams look like a fish skeleton.
- To construct a fishbone diagram the following procedure is used:

1. Write the real problem in a box (or circle) to the right of the diagram. Draw a horizontal line (the backbone) extending from the problem to the left side:



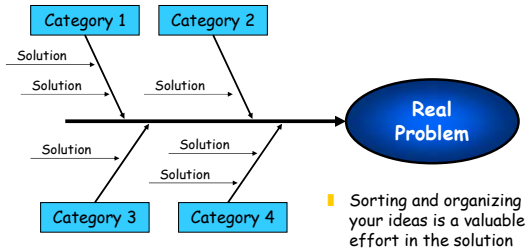
The Fishbone Diagram

2. Brainstorm potential solutions to the problem
3. Categorize the potential solutions into several major categories and list them along the bottom or top of the diagram. Extend diagonal lines from the major categories to the backbone. These lines form the basic skeleton of the fishbone diagram:



The Fishbone Diagram

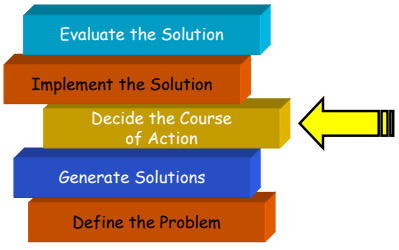
4. Place the potential solutions related to each of the major categories along the appropriate line (or bone) in the diagram



- Sorting and organizing your ideas is a valuable effort in the solution process

Deciding the Course of Action

- Problem solvers must juggle priorities all the time



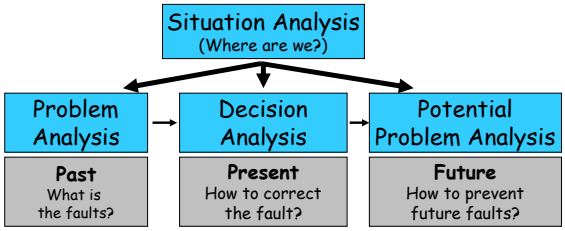
Deciding the Course of Action

- Once the real problem is defined and you have generated a number of possible solutions, it time to make some decisions:
  - Decide which problem to work on first
  - Choose the best alternative solution
  - Decide how to successfully implement the solution

Deciding the Course of Action

- An Organizational Approach for Decision Making

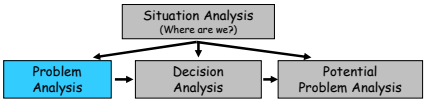
KT Approach (Kepner-Tregoe Approach)



KT Situation Analysis

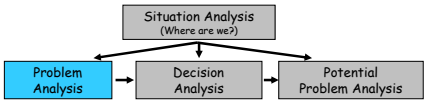
- KT Situation Analysis can be helpful in deciding which problem receives the highest priority
- Measure each problem using the following criteria:
  - Timing
  - Trend
  - Impact
- Each of the criteria are evaluated for there degree of concern:
  - High (H)
  - Medium (M)
  - Low (L)

KT Problem Analysis



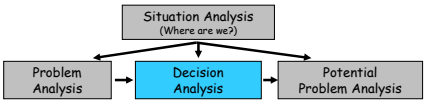
- Experienced problem solvers:
  - Ask the "right" questions
  - Interview as many people as necessary
- A technique used in KT Problem Analysis is:
  - Distinctions

KT Problem Analysis



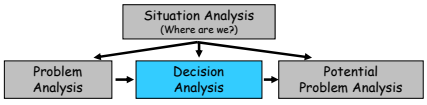
- What ***is*** the problem and what ***is not*** the problem?
- Where did the problem occur? Where is everything OK?
- When did the problem first occur? When was everything OK?
- What is the magnitude of the problem?

KT Decision Analysis



- How to choose the "***best***" solution from a number of alternatives
- Write a concise ***decision statement***
  - Collect and analysis information and data
  - Talk with people familiar with the problem
  - If possible, view the problem first hand
  - Confirm all findings

KT Decision Analysis



- Specify the objectives of the decision
- Divide these objectives into two categories:

musts and ***wants***

KT Decision Analysis

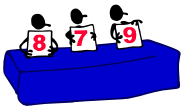
- ***Musts*** are mandatory to a successful solution
  - If a solution satisfies all ***musts*** then the solution is a "go"
  - If a solution does not satisfy any one of the ***musts*** then the solution is a "no go"

- ***Wants*** are desirable but nor mandatory

KT Decision Analysis

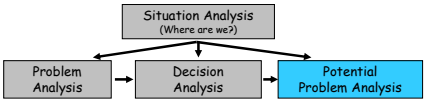
- Assign a ***weight*** (1 - 10) to each ***want*** on how important it is to you

- Assign a ***rating*** (0 - 10) as to how well it satisfies the ***wants***



- A score for the solution can be determined by multiplying the ***rating*** by the ***weight***

KT Potential Problem Analysis



KT Potential Problem Analysis			
Potential Problem	Possible Causes	Preventive Actions	Contingent Actions
A.	1. 2.		
B.	1. 2.		

KT Potential Problem Analysis

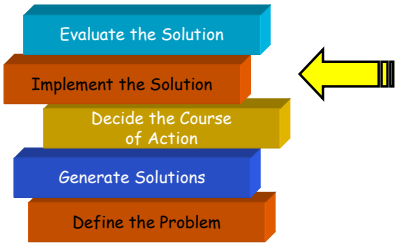
- Identify how serious each problem is
- How probable is it that the problem will occur?

Once Problems are identified

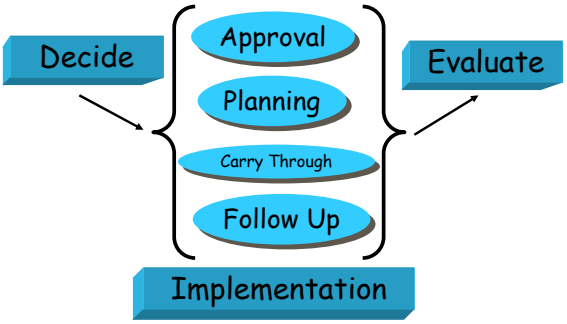
- List all possible causes
- Develop preventive actions for each cause

Implementing the Solution

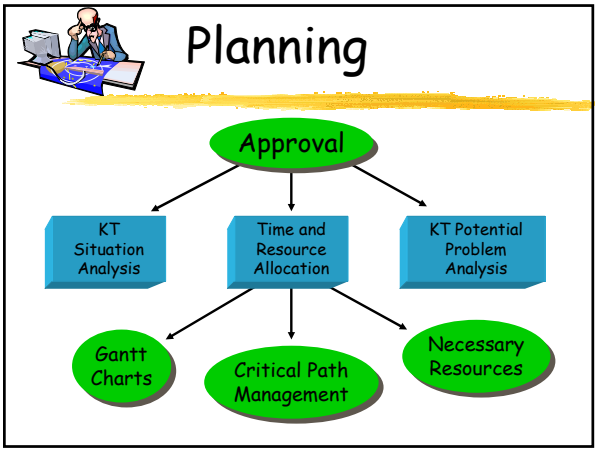
- There are a number of techniques that will facilitate the implementation process



Implementing the Solution



Planning



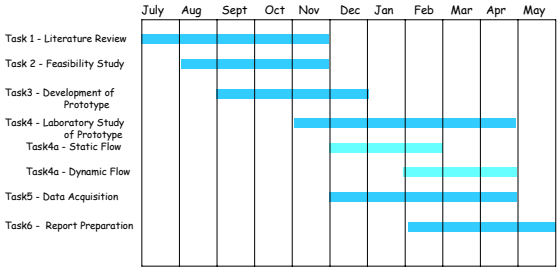
Planning

- Many people use a personal organizer to keep track of activities and commitments

- We will discuss four types of organization methods:
  - Gantt Chart
  - Coordination and development
  - Critical path
  - Necessary resources

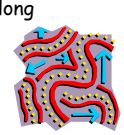
Planning

Gantt Chart



Planning

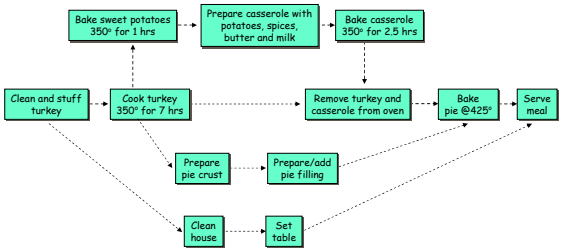
- **Critical Path** - Organizing critical tasks along a time line



- Develop an understanding of how one task effects other tasks in the project
- Use extensively in the construction industry
- Constructing a critical path is a **dynamic** process

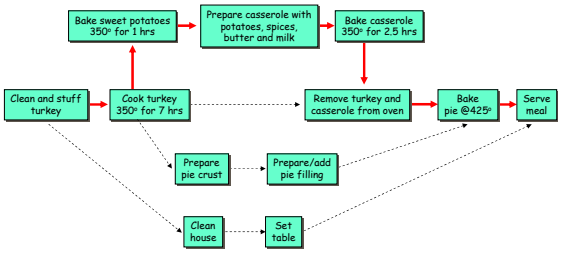
Critical Path Example

- Critical Path for Thanksgiving Dinner



Critical Path Example

- Critical Path for Thanksgiving Dinner



Planning

Necessary Resources

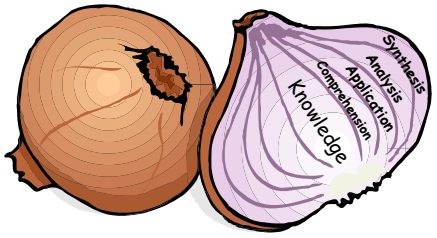
- Typically resource are divided into five categories:
  - Personnel
  - Equipment
  - Travel
  - Supplies
  - Overhead

Planning

I. Salaries and Wages		
A. Principal Investigator, C.V. Camp		
Summer, 2 month @ 66.67%	$	14,925
Extra Compenstation (1 month academic year @11.11%)	$	7,462
B. Shahram Pezeshk		
Summer, 2 month @ 66.67%	$	14,925
Extra Compenstation (1 month academic year @11.11%)	$	7,462
C. Undergraduate Research Assistant		
2 @ $6/hr (1280 hours)	$	15,360
Subtotal I	$	60,134
II. Fringe Benefits		
@ 17.65% of IA+IB	$	7,903
III. Travel	$	2,000
IV. Operating Expenses	$	15,000
V. Subcontract - Dr. Russell Deaton - The Univeristy of Arkansas	$	37,597
Total Direct Costs	$	122,634
VI. Facilities & Administration Costs @ 15% MTDC	$	18,395
Total Project Costs	**$**	**141,029**

Planning

- Revealing the Solution - *"It's like peeling an onion"*



Planning

Revealing the Solution

- **Evaluation** – qualitative and quantitative judgements about how material and methods satisfy problem criteria
- **Synthesis** – formulation of problem statement and testing procedures from "fuzzy" situations
- **Analysis** – break the problem into parts, identify missing, redundant, and and contradictory information

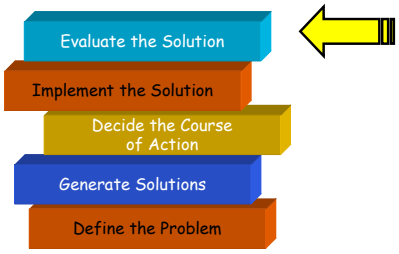
Planning

Revealing the Solution

- **Application** – organize which set of activities will be applied
- **Comprehension** – understanding, manipulation, and/or extrapolation of information generated or identified in the application step
- **Knowledge** – remembering previously learned material

Evaluation

- After implementation, a final evaluation of the solution is needed



Evaluation

Guidelines for evaluating your solutions

- Does it completely solve the problem?
- Is the solution ethical?
- Does the solution endanger people or the environment?


Evaluation

General Guidelines

- Evaluation should be a ***ongoing*** process
- Examine your solutions at each phase of the project
- Have an **independent review** of your work
- Do a **KT Potential Problem Analysis**
- Ask questions!!

Evaluation

The McMaster Five-Point Strategy

- Check that the solution is blunder-free
- Check the reasonableness of results
- Check that criteria and constrains are satisfied
- Check the procedure and logic of your arguments
- Confirm ***ALL*** findings!

Evaluation

Ethical Considerations

- *"Solutions are not always black and white with regard to ethics, but shades of gray"*
- Ethics Checklist
  - Is it legal?
  - Is it balanced?
  - How will it make me feel about myself?
  - Will it make me proud?



Evaluation

The Five P's

Purpose

Pride

Patience

Persistence

Perspective

End of Chapter 8