Problem Solving at ICOM 5047

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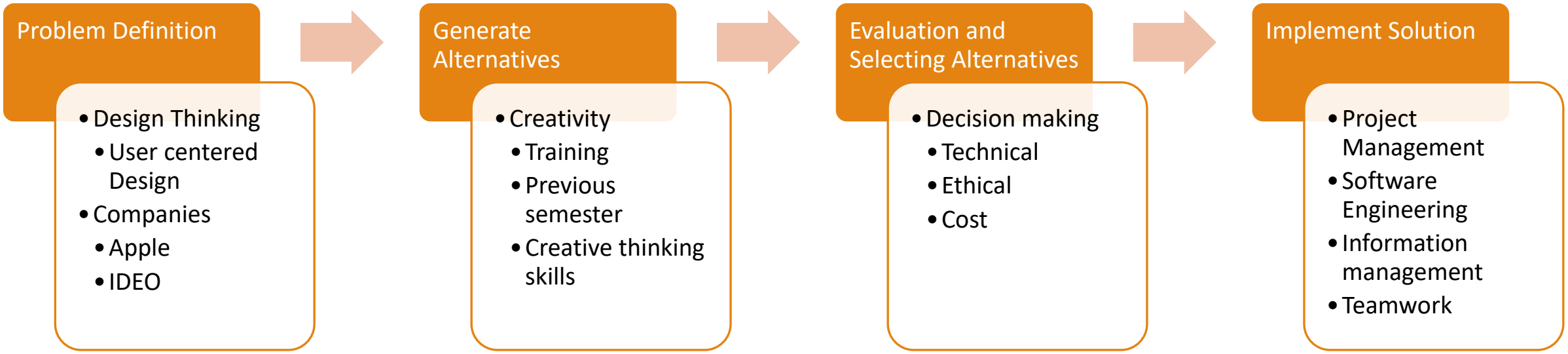
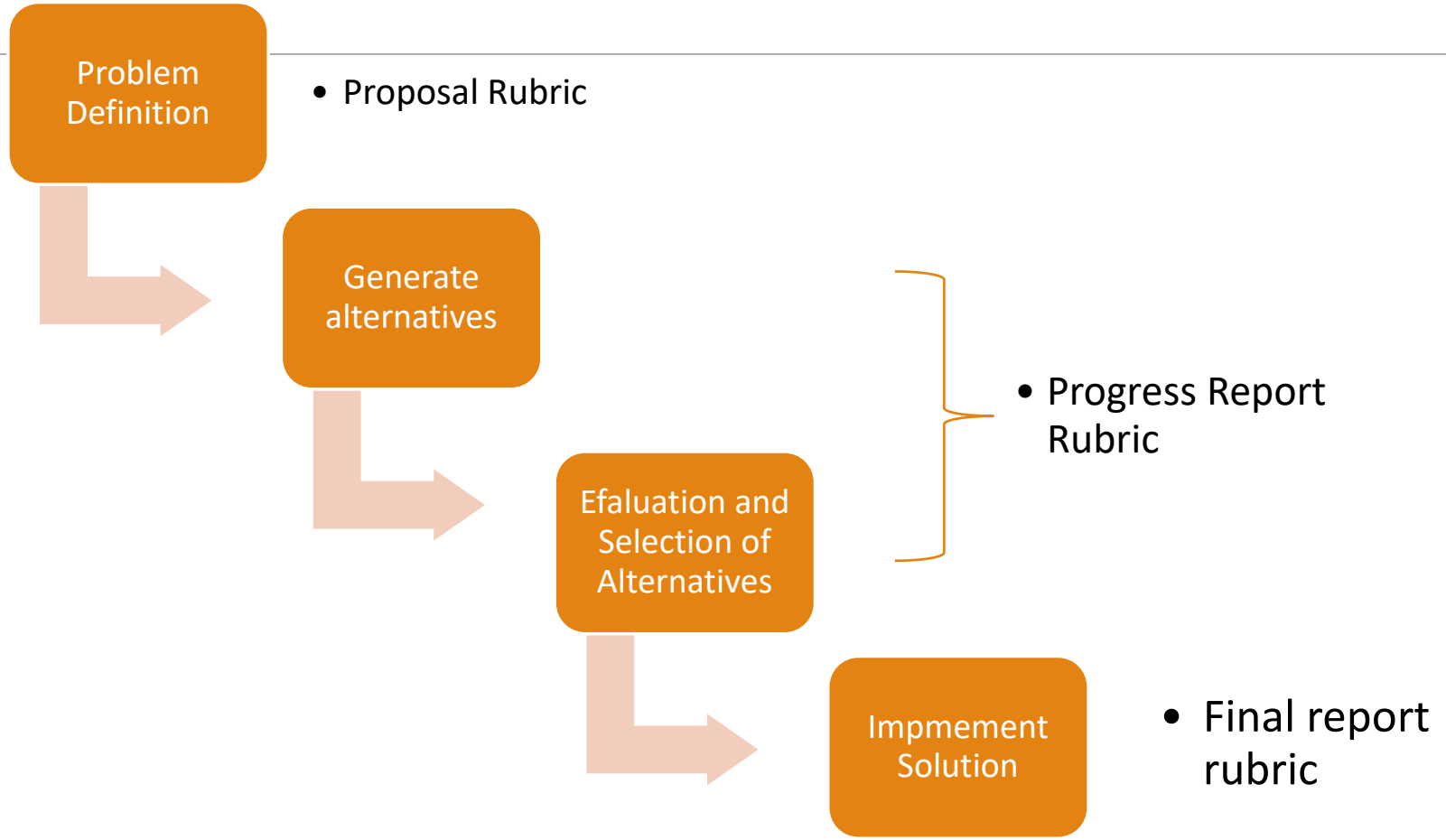
UPRM

Problem Solving Model

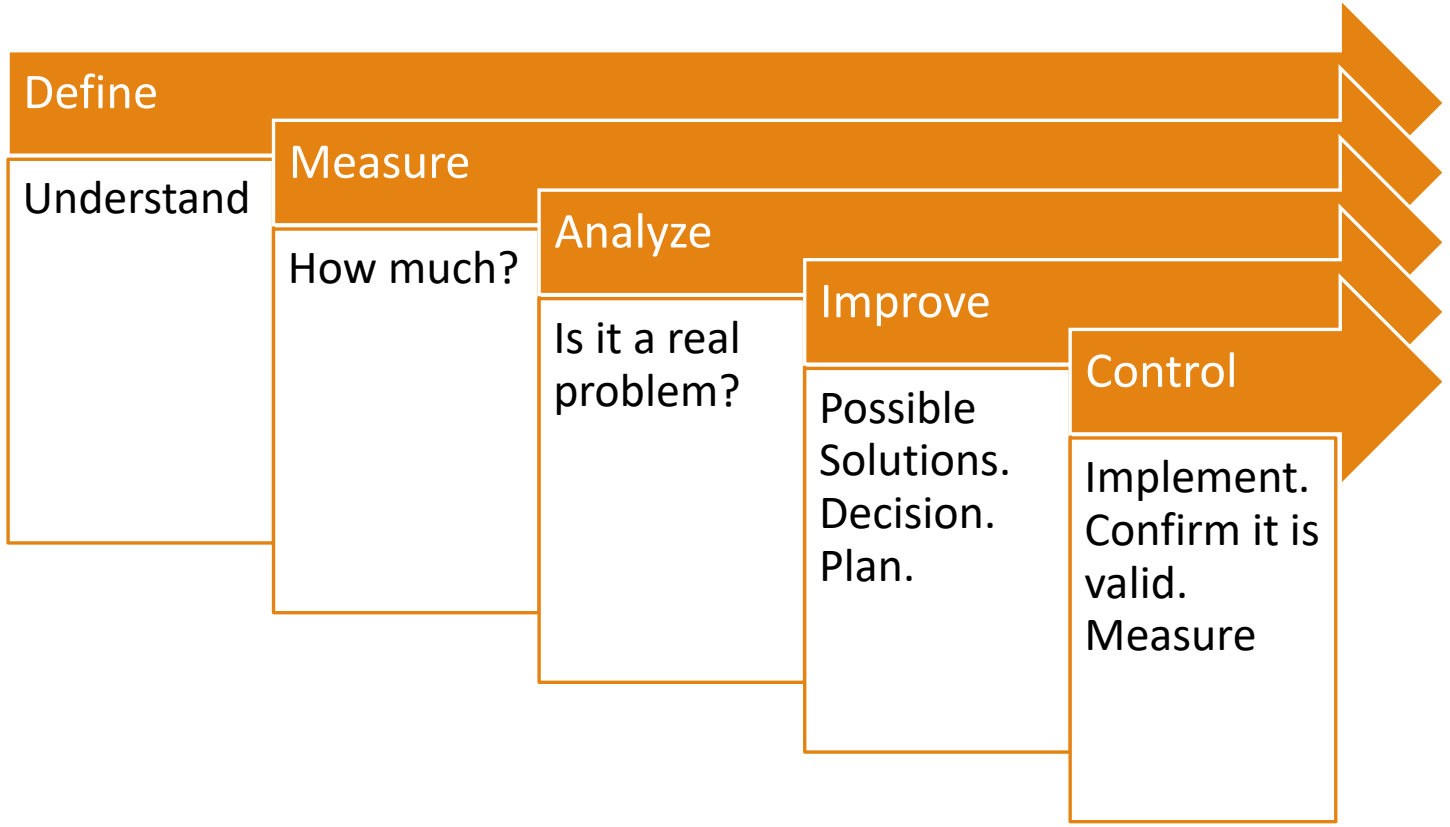


Rubrics


Problem Definition
Generate alternatives
Efaluation and Selection of Alternatives
Impmement Solution
• Proposal Rubric
• Progress Report Rubric
• Final report rubric

Problem Solving

Six Sigma DMAIC Problem Solving



To generate solutions

CREATIVE THINKING, INNOVATION

Innovation and Design Process

https://davidleeedtech.wordpress.com/2014/05/11/ideos-innovation-and-design-process/

Video

“**Enlightened trial and error** succeeds over the planning of the lone genius.” – Peter Skillman

“**Fail** often in order to succeed sooner.”

CREATIVE Techniques

TOOLS

Creative Techniques

False Faces

- Technique: reversal
  - How do you find ideas by reversing conventional assumptions

Brainstorming

- Brain Write
  - Generate as many ideas as possible

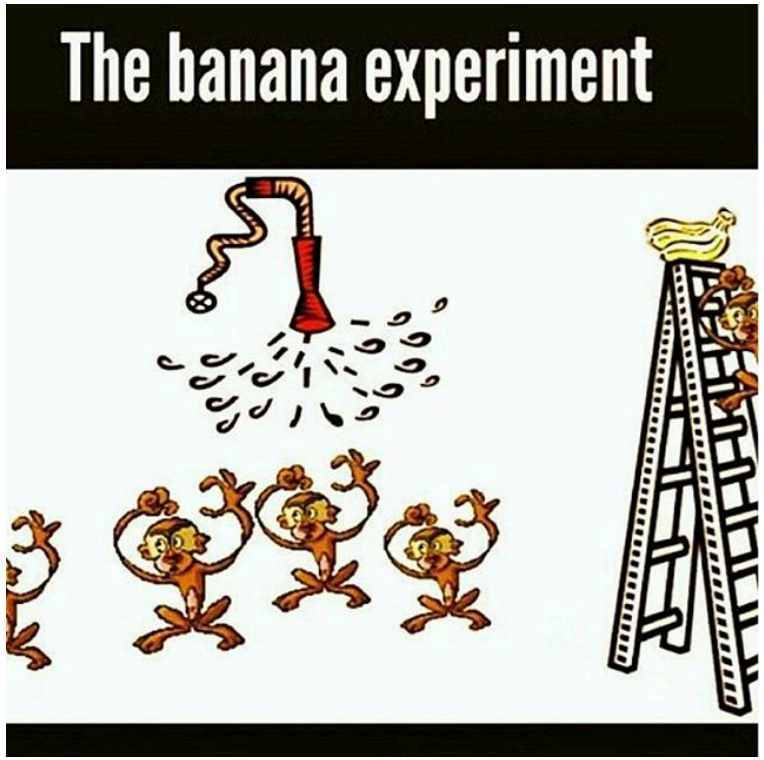
Idea Box

- Technique: Morphological Analysis
  - How to identify and box the parameters of a challenge to quickly produce thousands of new ideas.

Think Bubbles

- Mind Mapping
  - How to map your thoughts so as to spark new ideas.

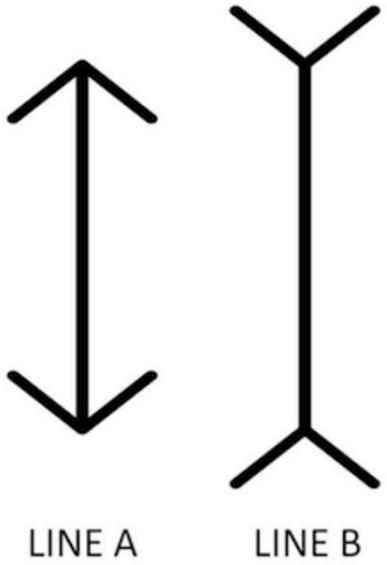
The banana experiment



Monkeys try to climb the ladder

- Showered with water

False Faces



Which one of these lines is longer???

Assumptions. They limit our knowledge

Reverse a challenge

State your challenge

List your assumptions

Challenge your fundamental assumptions

Reverse each assumption. Write down the opposite of each one.

Record differing viewpoints that might prove useful to you.

Ask yourself how to accomplish each reversal. List as many useful viewpoints and ideas as you can.

Assumption: Medical personnel must be close to patients to diagnose

Medical personnel can be far from patients

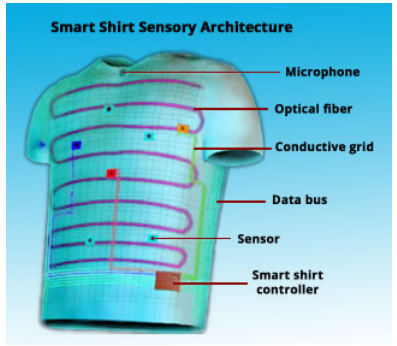
- Take Vital signs
  - Heart rate
  - Breathing
  - Body Temp
  - Dangerous gases

How?

- Tshirt
  - Combine textile engineering and computing.
  - Telecommunication

Smart Shirt

- Georgia Tech
  - Sundaresan Jayaraman
  - Sungmee Park
- Navy sponsored
- Wired optical and conductive fiber with sensors
- Monitor vital signs
- Transmit to remote location
- Treat wounded marine



Let’s practice

Project idea

- One of the Groups
  - Follow the procedure
    - State challenge
    - List assumptions
    - Challenge fundamental assumptions
    - Reverse assumption.
    - Record different viewpoints
    - Ask how to accomplish each reversal

Brainstorming

Brainstorming

Developed in 1941

- A. F. Osborne
  - Encourage
    - Group
    - Express ideas
    - Defer critical judgement

Uninhibited environments

- Imagination

Two basic principles

- Quantity breeds quality
- Defer judgement

Examples of judgement

- It cannot be done
- Someone must have done it
- The market is not ready
- Does not make sense

Brainstorm

NO Yes but

Use Yes and

Brain write

- Select a problem
- Choose participants
- Write ideas.
- Rotate, add to the previous idea.
  - No Yes but
  - Use yes and
- Read all the ideas

Let’s practice

Project idea

- Several of the students, write your project or problem
  - Follow the procedure
    - Brain write
    - Rotate

Idea Box

MORPHOLOGICAL ANALYSIS

Morphological box

Combine parameters of a challenge into new ideas

- Parameters
  - Characteristics
  - Factors
  - Variables
  - Aspects
- List parameters and variations of each parameter

Method

Specify the challenge

Select the parameters of the challenge

- Important parameters

List variations

- As many variations for the parameter

Try different combinations

- Random runs through parameters and variations
- Select and combine
- Do they fit the challenge?

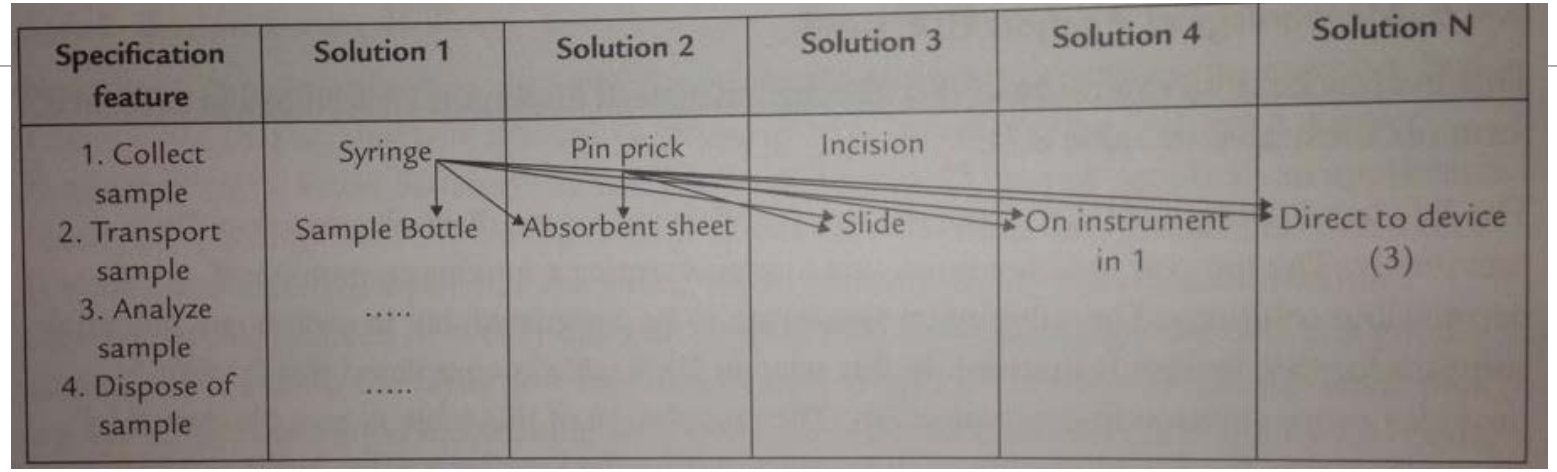
Example: medical devices course

Specification feature	Solution 1	Solution 2	Solution 3	…	Solution N
1 …. N					

Specification feature	Solution 1	Solution 2	Solution 3	Solution 4	Solution N
1. Collect sample	Syringe	Pin prick	Incision		
2. Transport sample	Sample bottle	Absorbent sheet	Slide	On instrument in 1	Direct to device (3)
3. Analyze sample	…				
4. Dispose of sample	…				

Material prepared
By L. Medina

- The basis of morphological analysis is to look for paths:
  - **How do the individual solutions "morph" into the bigger single solution?**



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4. Dispose of sample	.....				

- As we can see from the table, depending on which solution is picked for feature 1 a solution for feature 2 follows; it also enables us to see which solutions are "more versatile".
- An overall path, or a number of overall paths, should lead from the top to the bottom.
  - If a path is not possible, or incomplete, then another solution needs to be thought of and this can often provide focus.

Material prepared
By L. Medina

Think Bubbles

MIND MAPPING

Cognitive Mapping / Mind Maps

Definition: The representation of a person's reality as a "cognitive map" consisting of nodes and edges (linkages). Nodes are used to represent the person's concepts, including events, actions and values, and the edges are used to represent perceived causal relationships. Using a cognitive map, one can identify idea chains or explanatory paths.

Method

Map your impressions and thoughts about a challenge

Organization

- The way YOU THINK

Keywords

- Relevant

Associations

- Connections, links, relationships
  - Isolated?

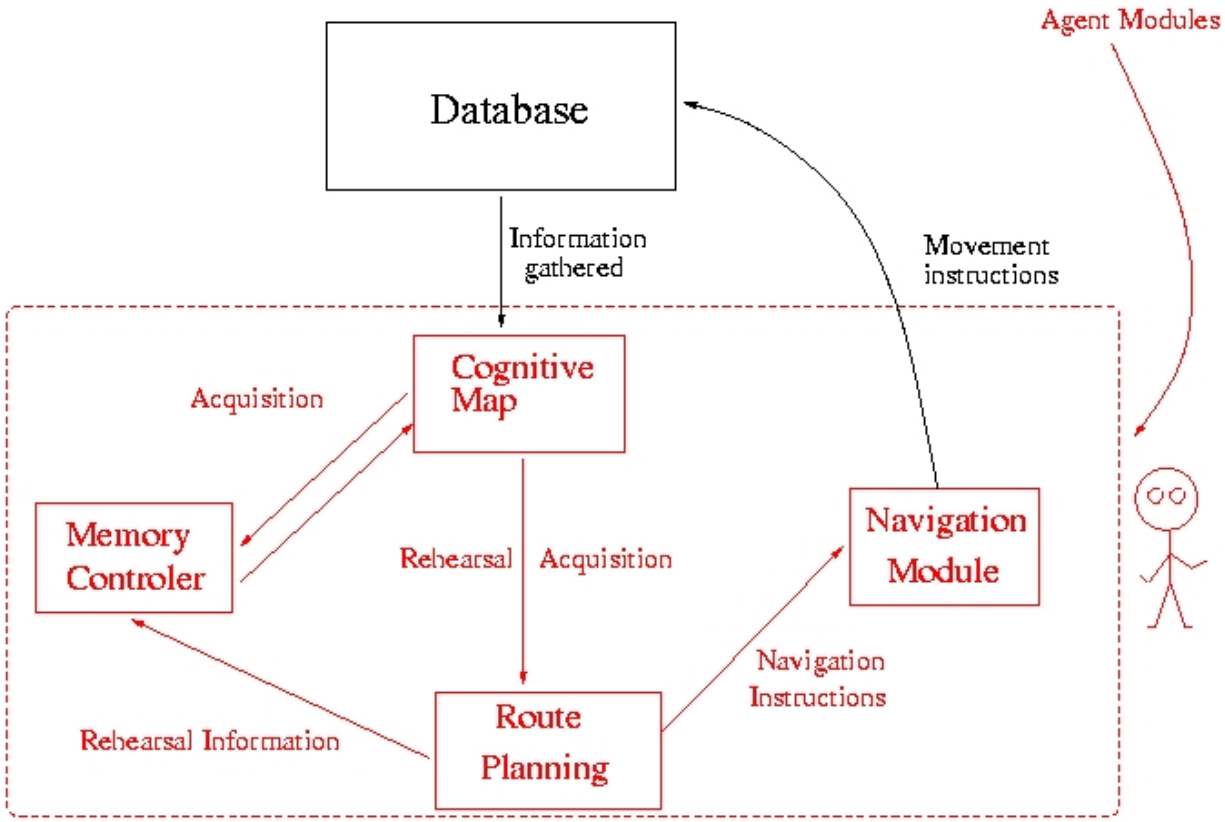
Clustering

- Test associations, find missing information, areas of need

Construction of Cognitive Maps

1. Code the text by identifying the concepts and the explicit or implicit causal linkages between them.
2. Construct a concept dictionary.
3. List relationships between concepts.
4. Draw the cognitive map.

Example


Agent Modules
Database
Information gathered
Movement instructions
Cognitive Map
Acquisition
Memory Controler
Rehearsal
Acquisition
Navigation Module
Navigation Instructions
Rehearsal Information
Route Planning

Let’s practice

Build a cognitive map of your project

Goals and Objectives

Definitions

Goal – Aspirational statement about what you want to achieve. Provides a framework for objectives and strategies.

Objective – Describes how to meet your goal using SMART criteria.

Measure – The number, percent or some standard unit used to illustrate success or impact over time.

Target - The desired level of performance you want to see that represents success.

Benefits of Good Goals and Objectives

Performance Management

Goals

What do you aspire to achieve?

- Broad
- Future oriented
- Frames objectives

Different than objectives (how are you going to get there?)

- Objectives are SMART

Specific

- Who / what?

Measurable

- Measure

Attainable

- How

Relevant/resourced

- Why

Time bound

- When

Goals

Disney

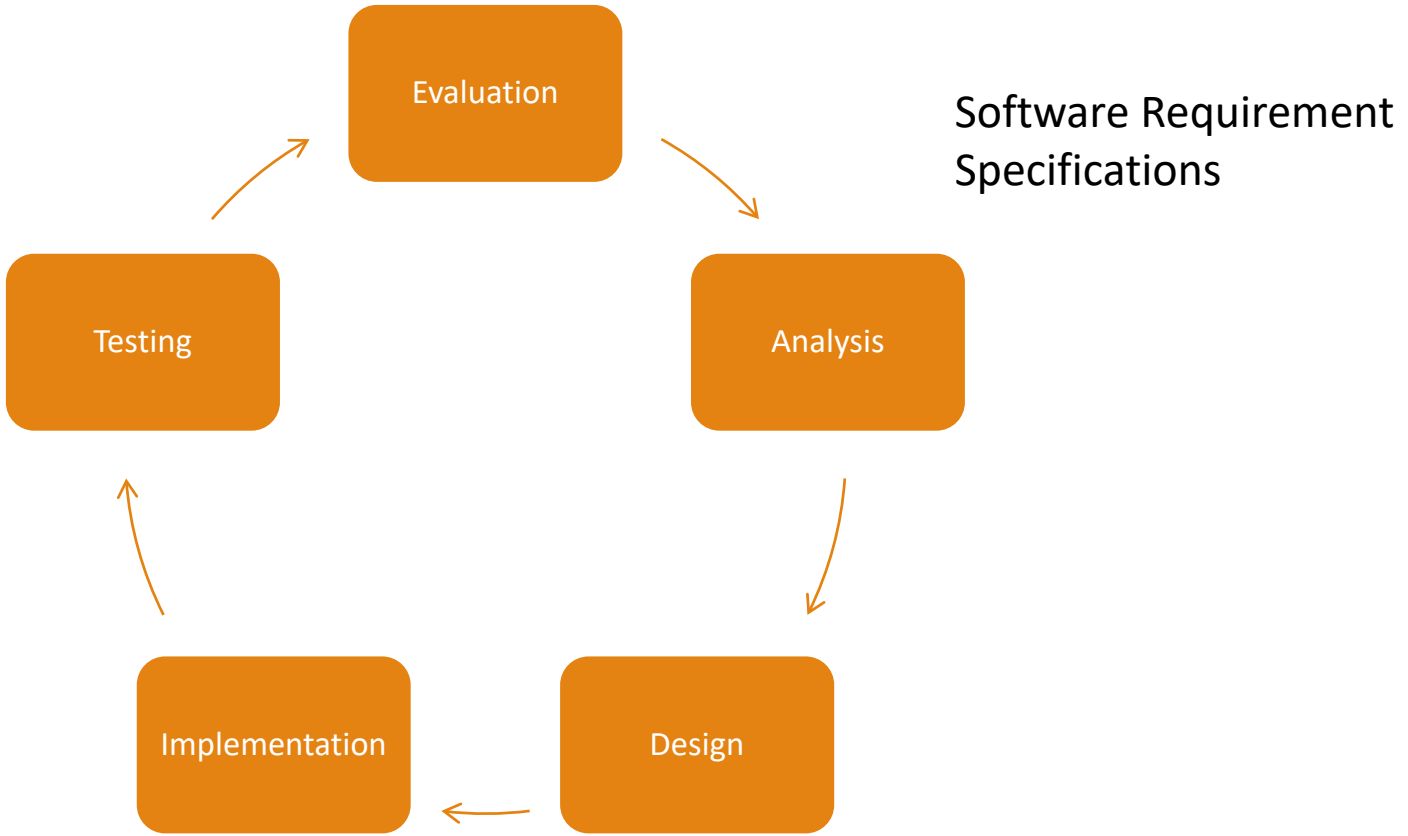
- Make people happy

If my goal is to be the most beautiful women on this campus.

- Objective
  - Loose 40 pounds in the next three weeks.

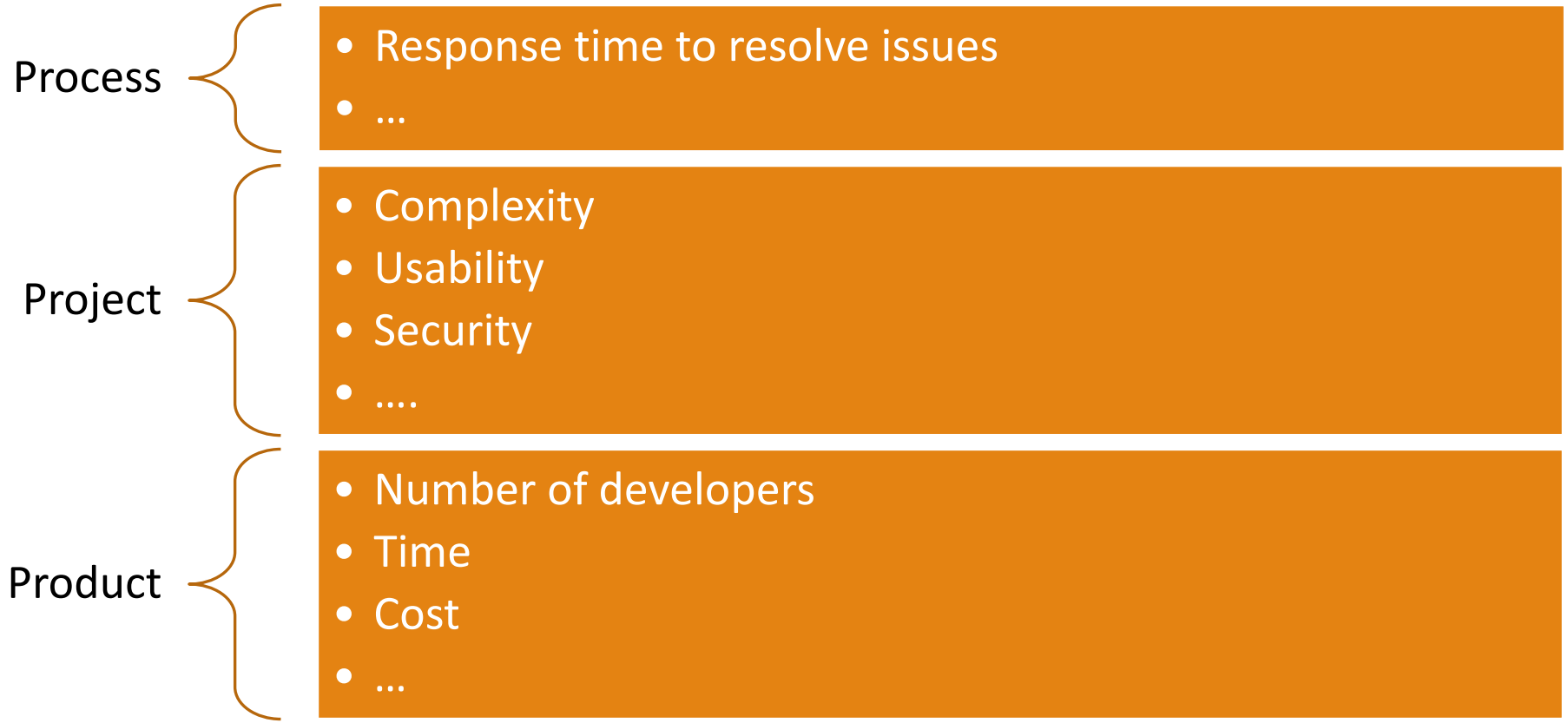
Software

Software Development Life Cycle



Software Requirement Specifications

Software Quality Metrics



Project QM

Correctness

Reliability

Integrity

Mantainability

Usability

Reusability

Portability

Interoperability

Testability

Efficiency

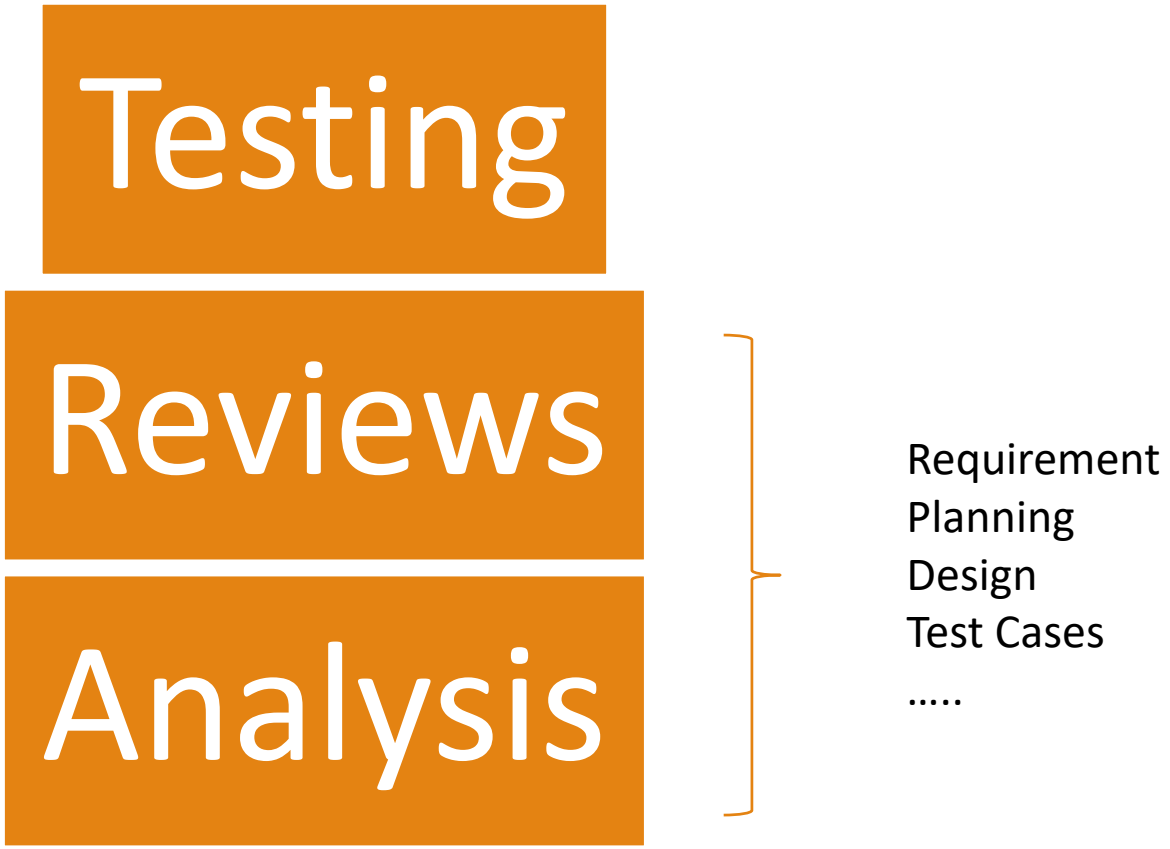
Availability

Capability

Security

…….

Software Quality Control



SQC: Testing

Testing - verifying and validating the specified requirements in the developed software.

Unit testing

Functional testing

Integration testing

System testing

Acceptance testing

Beta testing

Performance testing

Regression testing

Volume testing

Recovery testing

Usability testing

Stress testing

Load testing

Installation testing

Smoke testing

White box vs black box

Others….

A word on SDLC models

Waterfall

Iterative

Spiral

V Model

Agile

Prototype

…..

Apply according to your project….

References

Ogrodnik, P.J., (2012). Medical Device Design: Innovation from concept to market, Elsevier.

- Slides provided by Dr. Lourdes Medina.

Michalko, Michael. Thinkertoys: A Handbook of Business Creativity, Ten Speed Press, 1991.

Six Sigma for Dummies. Craig Gygi, Neil DeCarlo, Bruce Williams, 2005.