# Engineering Design - What is it?

## "Senior Design" – brief definition ?







# "Design" – Full Definitions : ABET

- "A ( ) of devising a system, component, or process to ( ) desired needs,"
- which involves "a ( ) process (often iterative), to convert resources optimally to meet the stated needs" by applying ( ), ( ) and ( ),
- with adequate consideration of ( ), ( ), and ( ) in the subject related to the electrical/computer engineering discipline."

# "Design" – Full Definitions: Industry

- "Determine that a (  ) exists with customers for specific goods or services and how much those customers are able and willing to (  ) for it.
- Then determine if the product or service is (  ) with the competencies of the company and if it can be manufactured at a (  ) that is less than the customers will pay.
- If so, proceed by designing to match the company's (  ) to manufacture,
- Finally, prior to full implementation, prepare a pilot (  )"

# Engineering Design in 3 phases

- **1. Problem Formulation**
- **2. Problem Solving**
- **3. Solution Implementation**

# Characteristics of Design

Design is:

- A ( ) through the 3 phases of
  ( ),
  ( ),
  and ( ).
- ( ), not trial-and-error
- ( ), not a recipe (nor a cookbook)
- ( ), not an event or product
- ( ), back to earlier phases
- ( ), to faithfully execute planned activities

# Characteristics of Design- continued

**Design should:**

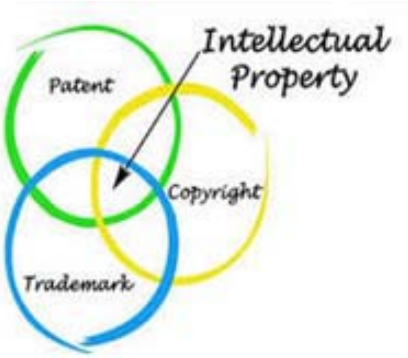
- **( ) with regulation, codes, rules, standards, etc**



- **Work under multiple and sometimes contradictory ( ):**
  - **Money, time, socio-cultural, etc.**

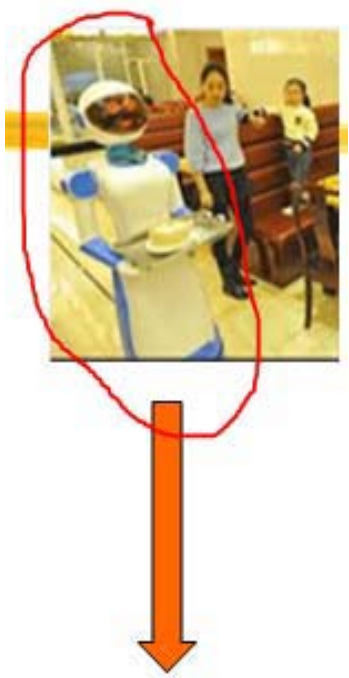

- **Perform with ( ) behavior and responsible action**


- **Understand and exercise ( ) Rights**



## Elements of *Unsuccessful* Design Projects: Lessons from Past Design Teams

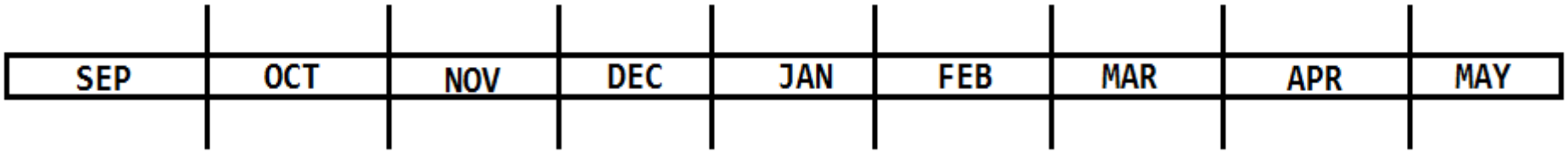
- Same skill sets of team members



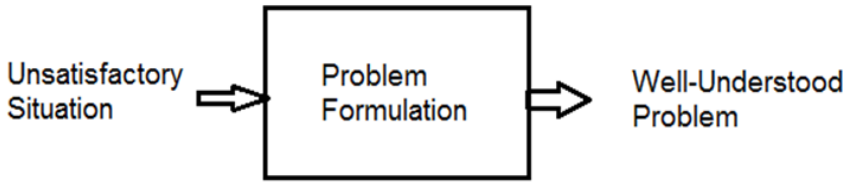
- Weak Team Dynamics

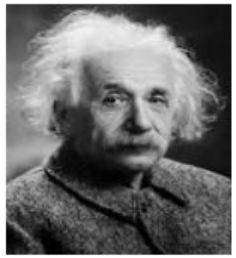
- Frequent Changes in Design

# Timeline and Milestones



# Design Phase 1 - Problem Formulation



- Problem Formulation:
  - Definition:
  - Focus:

- Why do we do this? What's the purpose?

# Identifying Needs and Defining Problem

- **Identify Needs**


Needs stock illustration
dreamstime.com

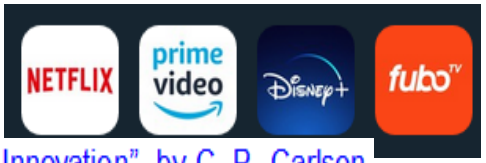
- **No Rush to get a solution ("Approach")**

# Blind Men and the Elephant


## Checkout Line Complaints: Problem Identification

# Practical Way of Problem Formulation


- **" Proposition N-B" Approach**




EXAMPLE: Proposition presented to a cable company executive for a video-on-demand system.

*Source: "Practice of Innovation" by C. R. Carlson

- **(Need) (Problem)**
  - Movie rentals represent a $5 billion business opportunity that you currently cannot access.
  - The only parts of rentals that people really dislike are the obligation to return the tapes plus the late fees.
  - Customers find that it is inconvenient and wastes time.

- **Benefits**
  - You will receive $5 of new revenue per movie rented, with a margin of 20 percent after paying for the movie costs.
  - Your customers will have all the pause and fast forward functions of a VCR when watching the movie, and they do not have to return the movie when done. Late fees are gone.
  - We estimate you could capture a market share of 20 percent.

- **Final 1-sentence "Problem Statement"** – combination of the essence of the Need and the Benefit
  - "The need of your company in the movie rental business in the current situation of customers' inconvenience and time-waste of tape/cd return is to quickly provide a means to eliminate the tape return requirement so that it may capture at least 20 percent market share."

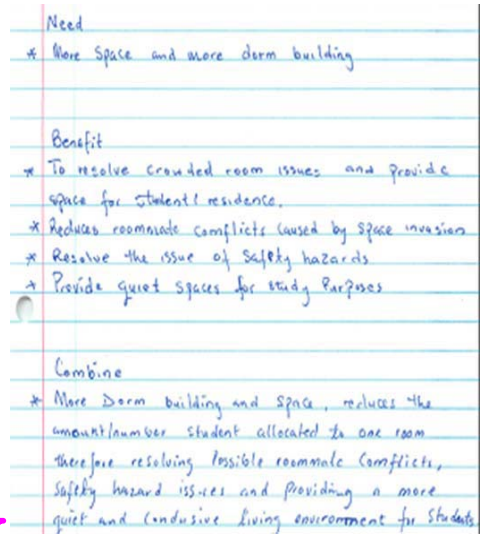
# Problem Formulation - Example

- Your customer
  - Crowded dorm room occupants

N-B proposition:

# Problem Formulation - Example

- Need:
  - * More space and more dorm building
- Benefits:
  - * To resolve crowded room issues and provide space for students,
  - * Reduce roommate conflict caused by space invasion
  - * Resolve the issue of safety hazards
  - * Provide quiet spaces for study purpose
- Problem Statement
  - More dorm building and space reduces the amount/number of student allocated to one room; therefore, resolving possible roommate conflict, safety hazard and providing a more quiet and conducive living environment for students


Need
* More space and more dorm building

Benefit
* To resolve crowded room issues and provide space for student's residence.
* Reduces roommate comflicts caused by space invasion
* Resolve the issue of safety hazards
* Provide quiet spaces for study purposes

Combine
* More Dorm building and space, reduces the amount/number student allocated to one room therefore resolving possible roommate Comflicts, Safety hazard issues and providing a more quiet and Conducive living environment for Students

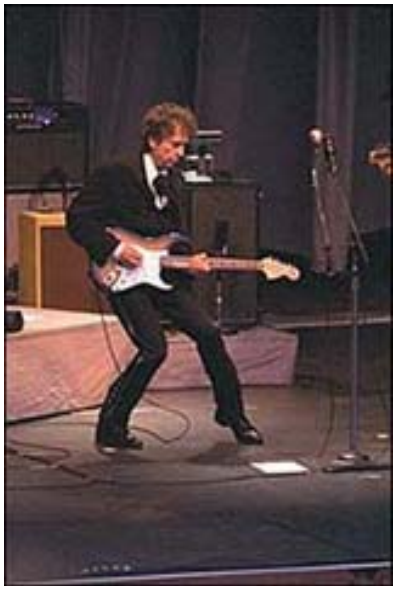
1. Write a need
   - Fit students into a room comfortably
2. Write a benefit
   - Less-clustered living space for students
   - Hygienic living space for students
3. Combine the need and benefit into one sentence statement
   - We need to accommodate students in a comfortable space to provide them with improved living conditions.

# Problem Definition:

# Problem Formulation Exercise

- Situation: You hear Jimmy Hendrix and Eric Clapton and their music teams complain of numerous wires (power, signal, etc.) on stage and of tripping hazard.
- You make a proposition to Jimmy Hendrix and Eric Clapton ("a wireless guitar amplifier" – but without mentioning this

- Exercise Focus: You write (a) need statements and (b) benefit statements, and combine them into (c) an 1-sentence problem statement
- Submission required
- Details of this exercise is in the accompanying assignment



# What is your team's Problem Statement?