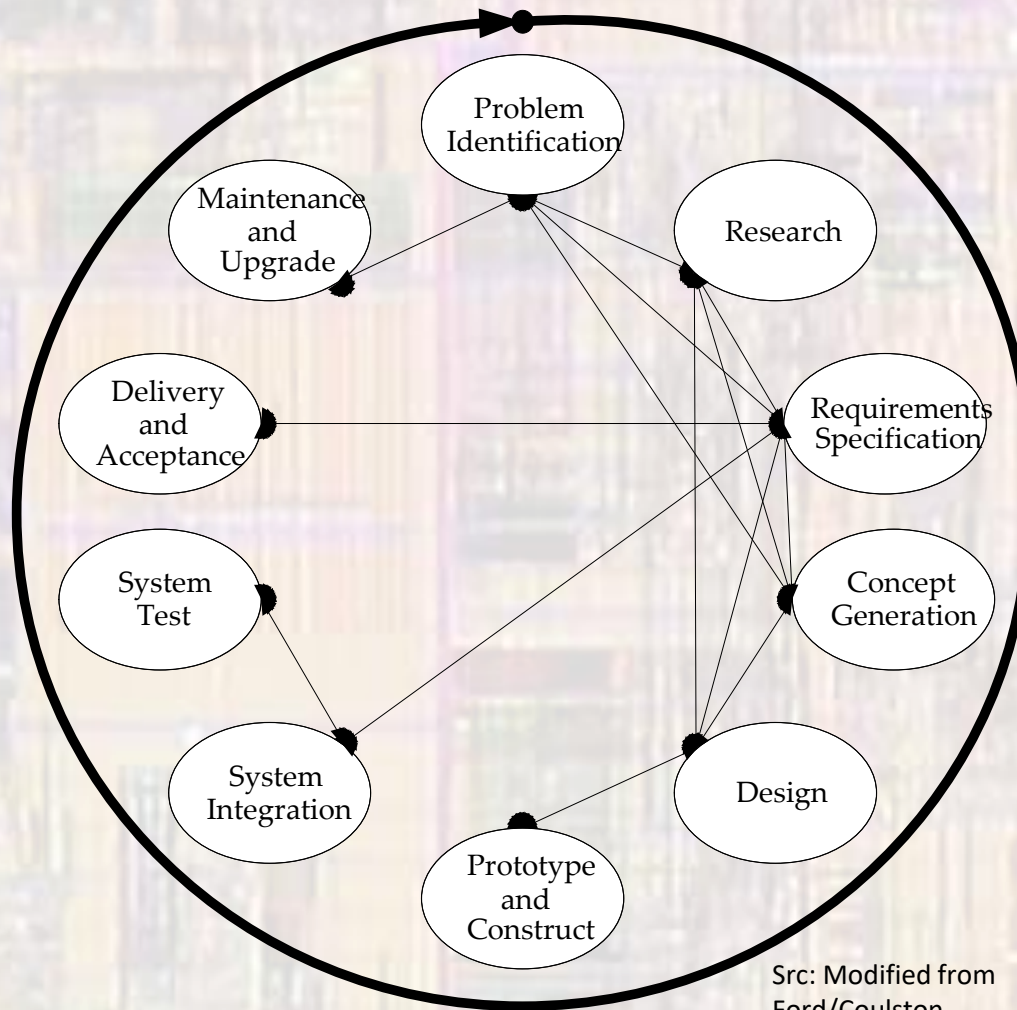# System Design Process

Last updated 7/14/23

Design Process

These slides outline the generalized design process used in most system designs. A system can range from a simple circuit to an entire mobile communications system

Upon completion: You should be able to describe each step of the generalized design process
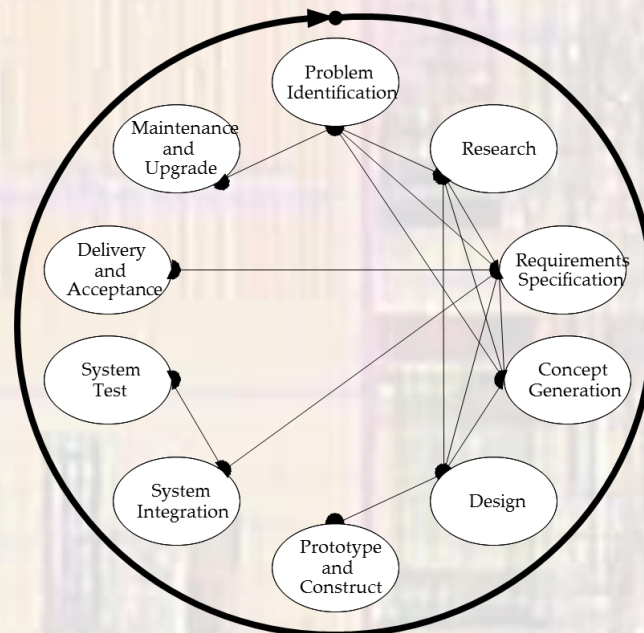
Design Process

- ## Generalized Design Process

Src: Modified from
Ford/Coulston

Design Process

- Generalized Design Process
  - Each element informs and feeds back to every other element
  - Must constantly ask: "how does the decision I am about to make impact my prior assumptions and future decisions".

Src: Modified from Ford/Coulston

Design Process

- Problem Identification

  - In most cases you will be given the problem to solve

  - It is critical to test this problem identification

    - Do you understand the problem

    - Is it the fundamental problem or an already half solved problem

    - Is it well defined, but not over defined

Design Process

- Research

  - Understand the underlying principles of the problem

  - Review current solutions

    - Look for gaps and opportunities to innovate

  - Become a subject matter expert

Design Process

- Requirements Specification

  - Identify what the system must do to solve the problem

    - Over specify:
      - Higher cost
      - Longer development time

    - Under specify
      - Don't solve problem
      - Customer does not accept the solution

  - No design solutions should be assumed at this stage

    - Maximize the design space

Design Process

- Concept Generation

  - Multiple design solutions are conceived

    - Initially these can be wildly creative

  - Each design solution is explored far enough to allow it to be compared to:

    - Requirements

    - Other possible design solutions

  - Typically, only one design solution emerges from this phase

Design Process

- Design

  - Hierarchical system design

  - Up/Down sub-system design

  - Detailed block, module, circuit, and software design

  - Heavy reliance on models and simulation tools

  - Tight feedback with prototyping phase

Design Process

- Prototyping and Construction

  - Used to inform the design process

  - Prototype small elements of the design in very tight loops

  - Prototype larger elements of the design at critical development points

  - For long lead time elements (e.g. Integrated Circuits) it is critical to make the right decisions on prototyping
    - More design time → less time to correct errors found in prototyping
    - Early prototyping → more errors → higher chance of errors in the fixes

Design Process

- System Integration

  - Pull everything together

    - Happens at multiple levels of the design hierarchy

  - Highlights specification errors (between sub-systems)

  - Highlights communications errors (between teams)

Design Process

- System Test

  - Test everything together

    - Happens at multiple levels of the design hierarchy

  - Validates the system to the original Requirements Specifications

    → does it solve the original problem

Design Process

- Delivery and Acceptance

  - In situ testing

    - Validate the solution

    - Uncover unexpected interdependencies

    - Frequently require "tweeks" to the solution or the system

Design Process

- Manufacturing

  - Determine manufacturability

    - Component robustness

    - Overall system yield

    - Complexity