Standards, Project Management, & OneNote

ECE 403 Senior Design II

Week #2

Please visit Bison Academy for corresponding lecture notes,
homework sets, and videos
www.BisonAcademy.com

Standards:

A standard is an established norm that specifies engineering methods, processes, and practices. There may be standards related to your project. Some places to go to look for these are:

ANSI (American National Standards Institute)

https://www.ansi.org/
ANSI is the national coordinator of voluntary standards activities in the U.S. ANSI approves and publishes standards after they are developed by various engineering, industry and professional groups. ANSI is the U.S. representative to the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). ANSI does not produce standards.

Code of Federal Regulations (CFR)

https://www.federalregister.gov/
The Code of Federal Regulations is the codification of the general and permanent rules published in the Federal Register by the Executive Department and agencies of the Federal Government.

European Telecommunications Standards Institute (ETSI)

https://www.etsi.org/standards#Pre-defined%20Collections
ETSI (European Telecommunications Standards Institute) is an independent, not-for-profit, standardization organization in the field of information and communications. ETSI supports the development and testing of global technical standards for ICT-enabled systems, applications and services.

International Electrotechnical Commission (IEC)

https://www.iec.ch/homepage
The International Electrotechnical Commission (IEC; in French: Commission électrotechnique internationale) is an international standards organization that prepares and publishes international standards for all electrical, electronic and related technologies – collectively known as "electrotechnology". IEC standards cover a vast range of technologies from power generation, transmission and distribution to home appliances and office equipment, semiconductors, fiber optics, batteries, solar energy, nanotechnology and marine energy as well as many others.

Institute of Electrical and Electronics Engineers (IEEE)

https://standards.ieee.org/

The Institute of Electrical and Electronics Engineers Standards Association (IEEE SA) is an operating unit within IEEE that develops global standards in a broad range of industries, including: power and energy, artificial intelligence systems, internet of things, consumer technology and consumer electronics, biomedical and health care, learning technology, information technology and robotics, telecommunication and home automation, automotive, transportation, home automation, nanotechnology, information assurance, emerging technologies, and many more.

International Organization for Standardization (ISO)

https://www.iso.org/home.html

The International Organization for Standardization (ISO) is an international standard-setting body composed of representatives from various national standards organizations. Founded on 23 February 1947, the organization develops and publishes worldwide technical, industrial and commercial standards. It is headquartered in Geneva, Switzerland and works in 166 countries.

International Telecommunications Union (ITU)

https://www.itu.int/en/publications/Pages/default.aspx
The International Telecommunication Union (ITU) is an international organization that provides global telecommunication standards. ITU-T Recommendations (standards), form the foundations of the information and communications technologies of today.

National Institute of Standards and Technology (NIST)

https://www.nist.gov/
The International Organization for Standardization (ISO) is an international standard-setting body composed of representatives from various national standards organizations. Founded on 23 February 1947, the organization develops and publishes worldwide technical, industrial and commercial standards. It is headquartered in Geneva, Switzerland and works in 166 countries.

Homework #2

- 1st Part

Go through the previous links

- Look for standards related to your project

Update your OneNote document

- Where you searched
- What relevant standards you found
- (if any)

OneNote SD403_XX_YY		
Section	**Pages**	**Content**
Contact Information	Contact Information	phone & email addresses
HW2: Project Charter	Project Description	*short description*
	Project Charter	*Deliverables* *Key elements* *Time allocated* *Budget*
	Biweekly Meeting Dates	*when you group meets with sponsor*
	Relevant Standards	*Search for and include references to relevant standards*
	Work Breakdown Structure	*Major Activities (level 3)* *Tasks (level 4)*

OneNote & Senior Design

OneNote works really well for Senior Design

- OneNote serves as a diary for each student.

  All of your work is placed in your OneNote document.
- OneNote is very versatile.

  Add text, photos, videos, Word documents, Excel spreadsheets, etc.
- OneNote makes grading really easy

  Instructors just open your OneNote document to see your work
- OneNote makes revising your grades really easy.

  Grades are updated every 2 weeks
  If you don't like your grade, revise and improve your section of OneNote
  note: Last day for revisions is Friday of dead week
- OneNote makes transitioning to Design III easy

  Keep using the same OneNote document

also also, no 50+ page report is needed at the end of Design II and Design II

Your OneNote document is your final report

Project Charter & OneNote

- Part of homework #2
- Possibly the most important document in any project

This document specifies

- Deliverables for the project

  varies
- Key elements for the project

  varies
- Time is allocated

  two semesters
- Budget

  $300 usually

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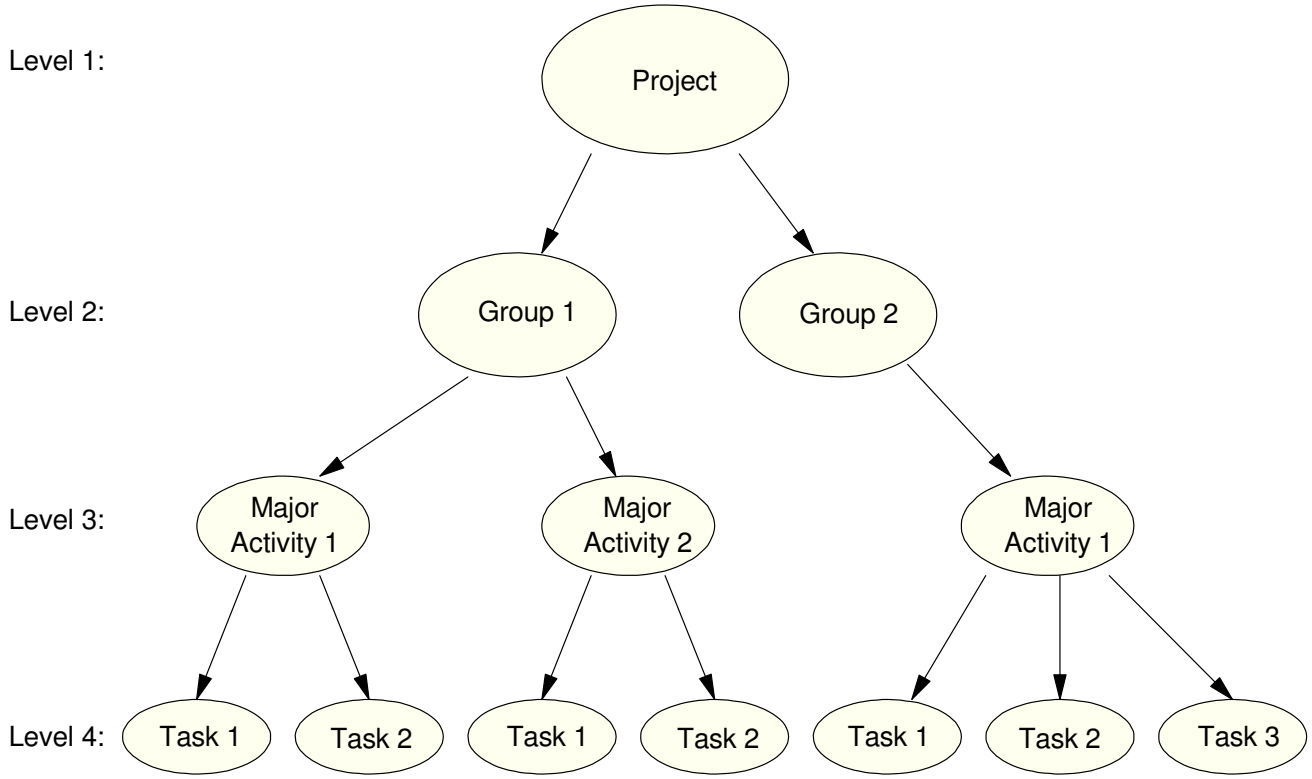
Work Breakdown Structure

Once the project is defined, the next task is to split the project into smaller tasks

- Sort of a divide and conquer technique.
- Once the tasks are small enough, you can start knocking them off one by one.



Work Breakdown Structure

Level 1: Define by the *project charter*.

Level 2: Split the project

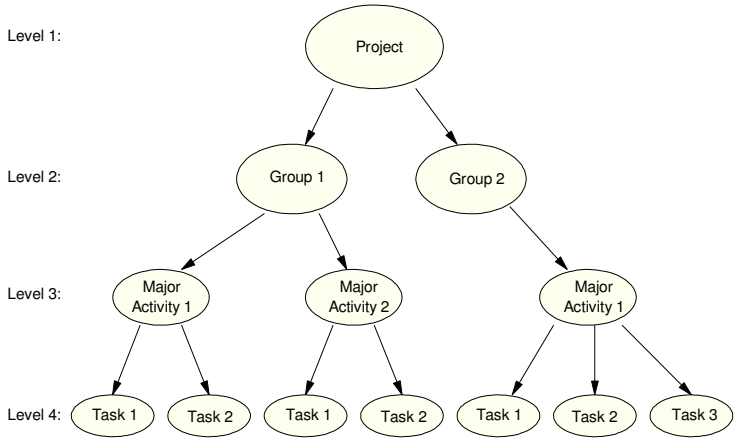
- by department or by functionality
- Not really needed in Senior Design

Level 3: Specify the major parts

- Major technical challenges for Sr Design

Level 4: Tasks.

- What are the tasks that need to be completed



Level 3 Example

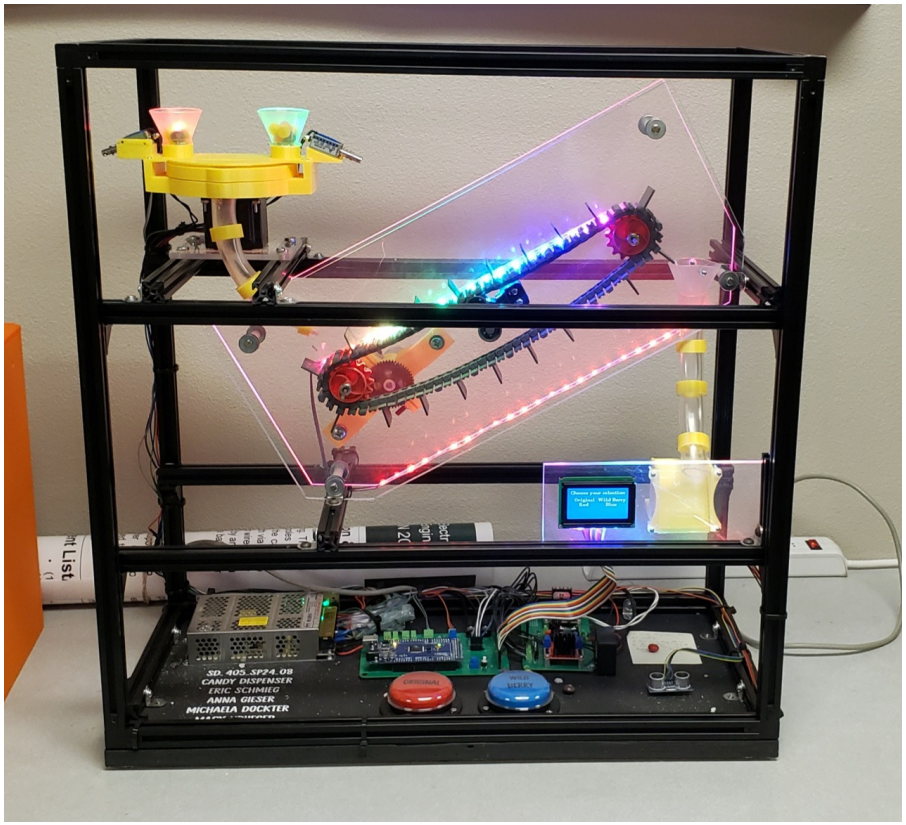
- Candy Dispancer

Level Split (option 1)

- Sensors: Detecting inputs
- Actuators: Driving motors, lights, displays
- Packaging: Making a frame that's sturdy and portable

Level 3 Split (option 2)

- Software: Reading the sensors & driving the actuators
- Hardware: Circuits for motors, lights, displays, sensors
- Mechanical: Making a frame that's sturdy and portable



Level 4 Tasks

- Part of homework #2

This is really what you want: a list of tasks

This list of tasks is *really* important

- This list defines your to-do list for Design II and III.
- This list is what you'll use in homework set #3 when you splits the tasks among members of your group.
- This list is what you'll work on for the rest of Design II: start knocking off tasks one by one.
- This list is pretty much what will determine your grade in Design II.

Put time into this section of homework #2

Level 4: Candy Dispencer

Sensors:

- Button: Detect when a button is pressed (regular or tropical fruit skittles)
- Optical Sensor: Detect when a candy drops through a chute
- Range Sensor: Detect when your hand is under the dispenser.

Actuators

- Lights: Make the lights move, following the candy
- Solenoid: Drive a solenoid so that it taps the candy three times
- DC Servo Motor: Rotate the selector either left (regular) or right (tropical fruit)
- Stepper Motor: Drive a stepper motor to drive the conveyor belt

Software:

- Select a microntroller capable of reading the sensors and driving the actuators
- Select a programming language that everyone can live with

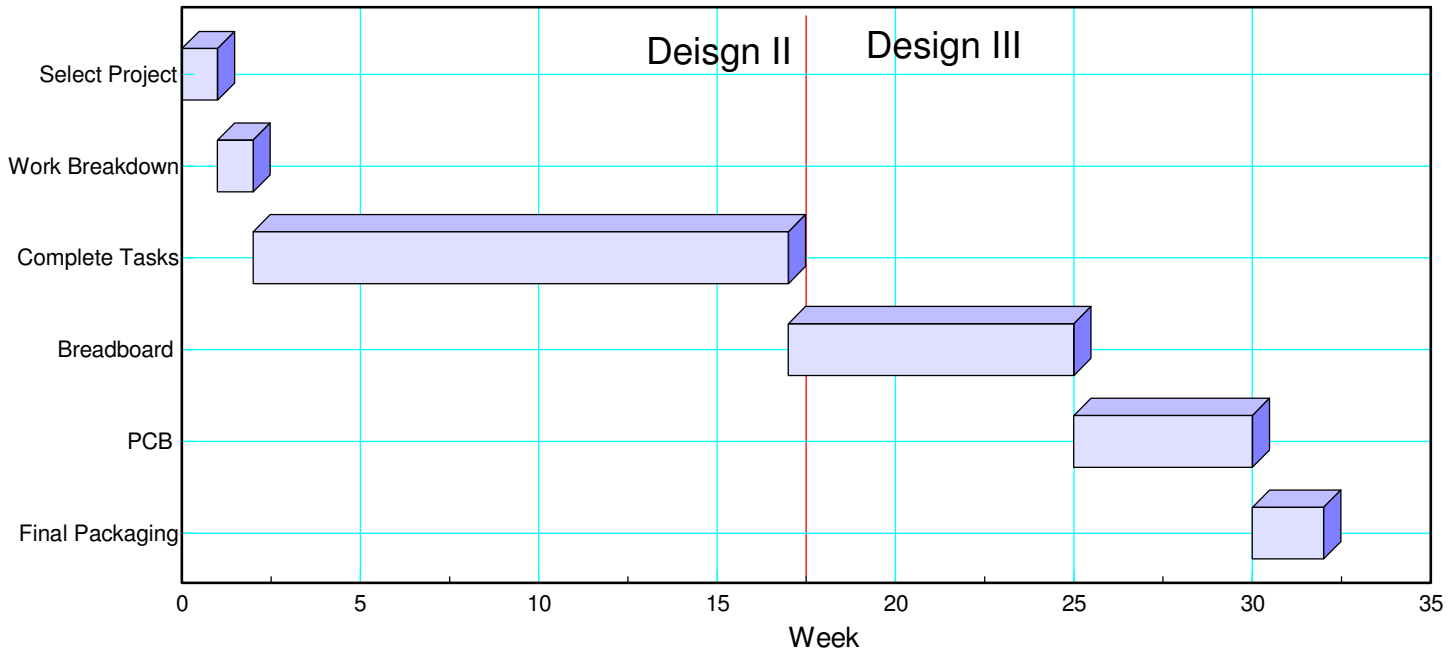
Packaging

- Layout of the Candy Dispenser
- How to make parts with a 3d printer

Gantt Chart

Once the major tasks to complete a project are defined, specify

- Start, end, and time allocated for each activity
- Pretty much specified by the start and end of the semester



Project Management Techniques

Design I used waterfall

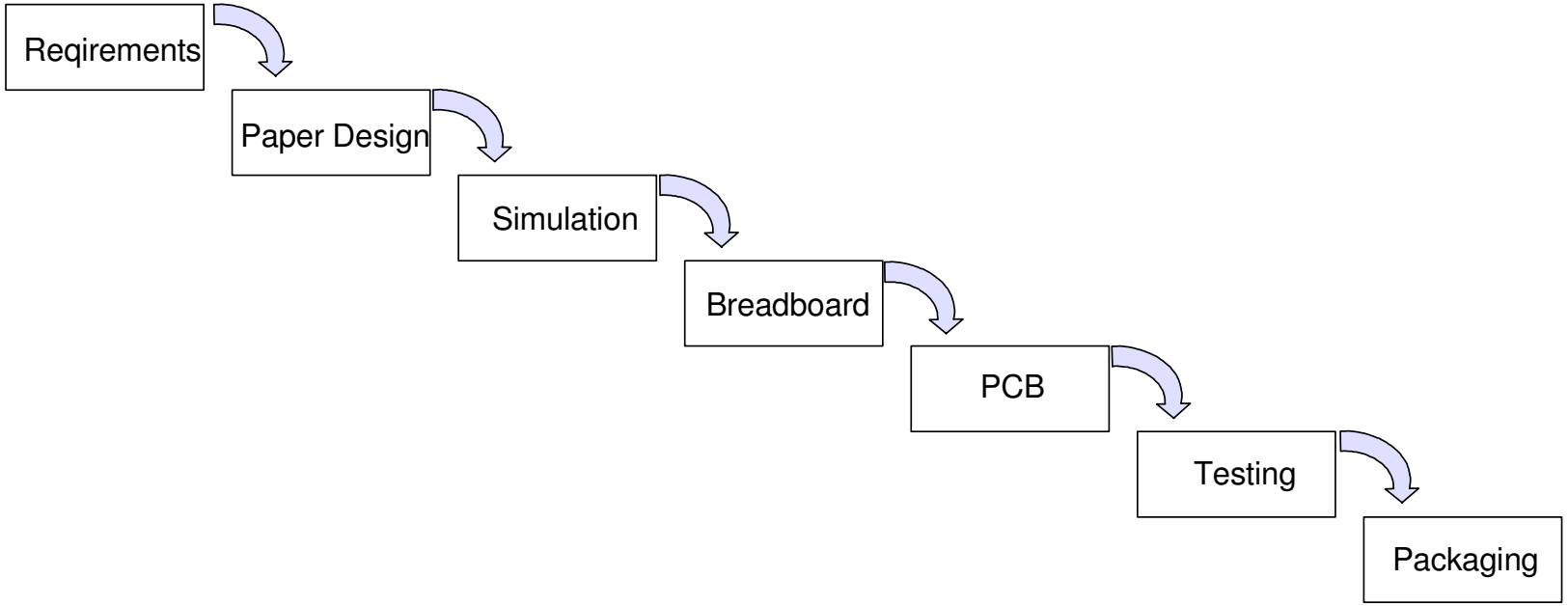
You're free to use any technique you like in Design II and III

- Critical Path
- Waterfall
- Agile
- Total Quality Management
- other

Waterfall

The idea behind *Waterfall* is

- A given project can usually be split into a set of tasks that need to be completed.
- One way to complete the overall project is to complete these tasks one at a time.
- The *waterfall* shows you the order in which these tasks will be completed.



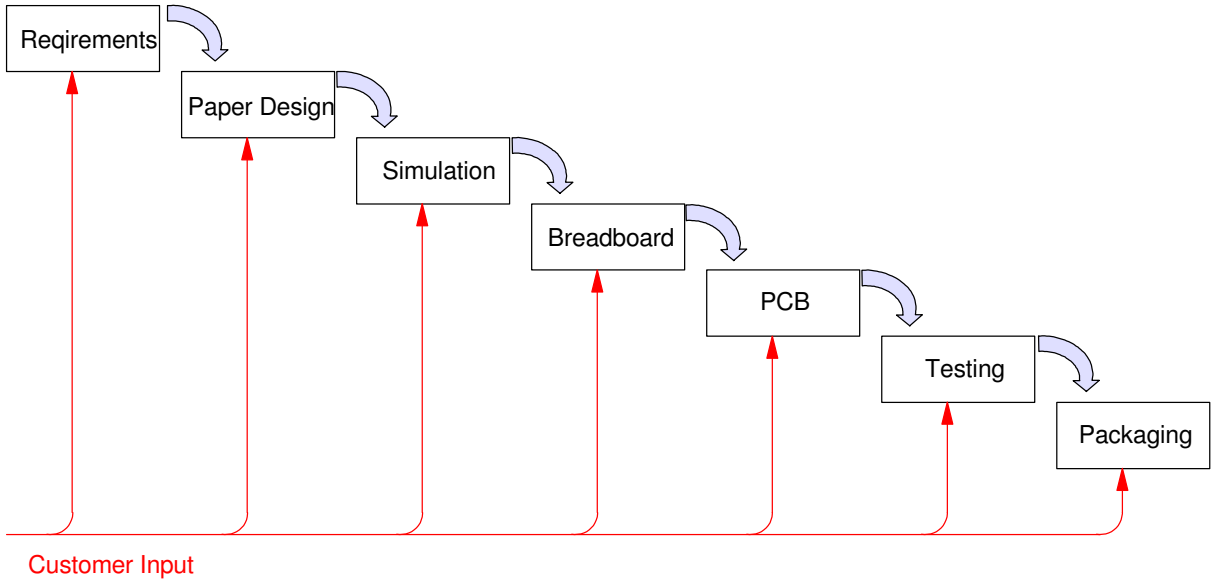
Waterfall for Senior Design

- Requirements Capture: Define the inputs, outputs, and how they relate.
- Paper Design: Analysis and calculations for circuits and/or programs which meet these requirements.
- Simulation: Test your hardware design in simulation or test your software with test programs.
- Breadboard: If your design works in simulation, build it on a breadboard to get the schematics correct.
- PCB: Transfer your breadboard design to a printed circuit board.
- Testing: Check that final design meets the system requirements.
- Packaging: Place your final design in a package for delivery to your customer (ECE 405 only).

Waterfall projects can be very agile and responsive to customer input.

- There is nothing stopping you from having customer input and alterations to the design along the way.
- Often times, this is necessary: customers often times don't know what they want until they see it.

As the customer sees your project progress, he/she may get a better understanding of what they really need and what can be delivered.



Critical Path

The idea behind Critical Path is that

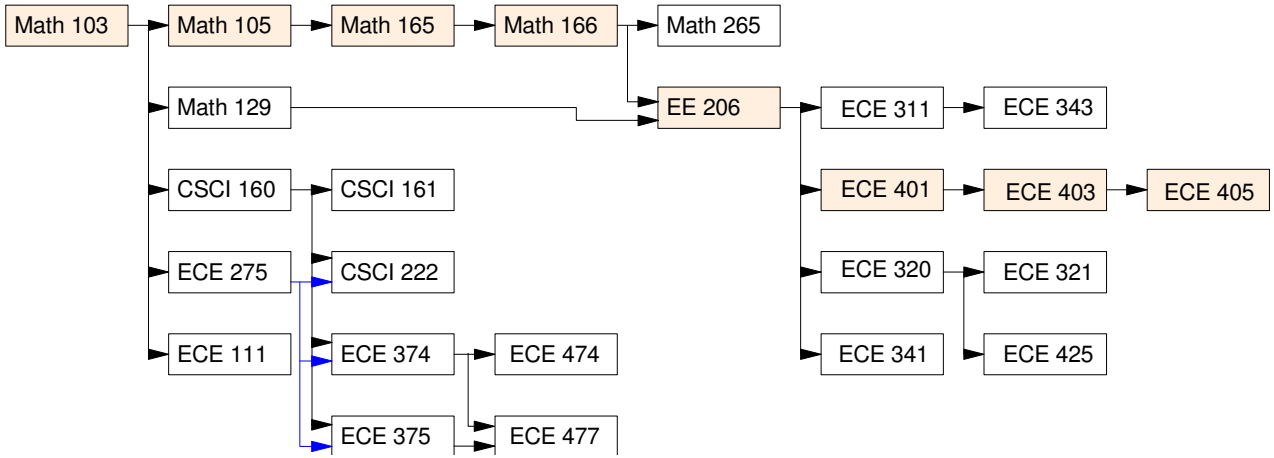
- Most projects can be broken down into smaller parts.

  To graduate from NDSU in Computer Engineering, for example, you need to take and complete forty courses.

- Some things have to be done sequentially.

  You can't shingle a roof until you have a roof.
  You can't take Calculus II until you complete Calculus I.

If you lay out all of the tasks in the order of when they can be completed, you'll see the longest path from start to finish, This is the critical path.



What the critical path tells you is

- If you want to graduate in the minimum time possible, you *need* to be taking the next course in this sequence each semester. If you skip a semester, you postpone graduating.
- The other courses can be moved around to even out the workload each semester - providing you are abiding by the prerequisites.

The same holds in Senior Design.

- If you break your project down into smaller chunks then arrange these by the order they need to be completed, you'll see which activities form the critical path.
- At any given time, you need to be working on the next item in this path.
- If you don't, your end date will slip.

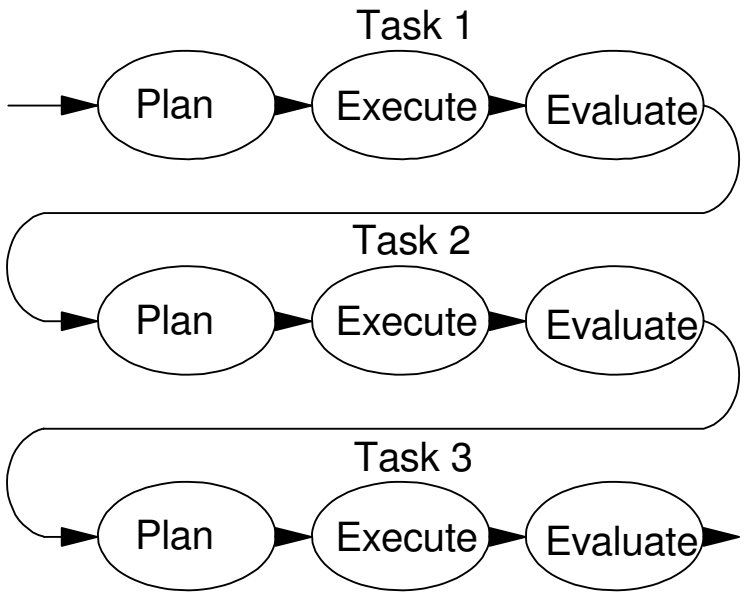
Agile

An iterative design

The idea is to

- Split the project into smaller tasks, then
- Go through the entire design sequence for each task, one by one (requirements, paper design, breadboard, PCB design, validation)

Essentially, the goal is to slap out a prototype quickly, then iterate on improving this prototype over and over.

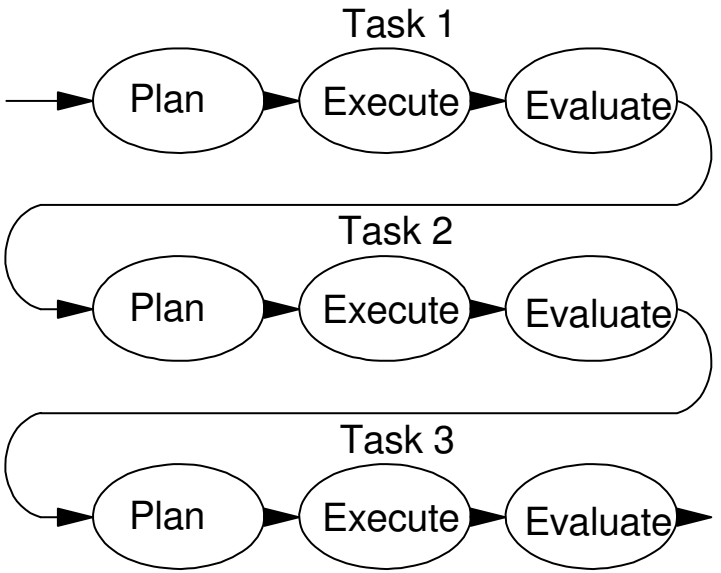


Agile Example

- Build a stoplight

One way to split up the tasks are

- Physical Design
- User Interface
- Traffic Sensors



1st Iteration: user interface

- Cell phone app

  shows you what the stoplight is doing
- Go through the design cycle

  plan - execute - evaluate

2nd Iteration: physical stoplight

- Hardware controlled by cell phone app

  controlled by the cell phone app
- Go through the design cycle

  plan - execute - evaluate

Total Quality Management (TQM)

Problem: Company A is trying to design and build a widget.

- The hardware group starts with the design.

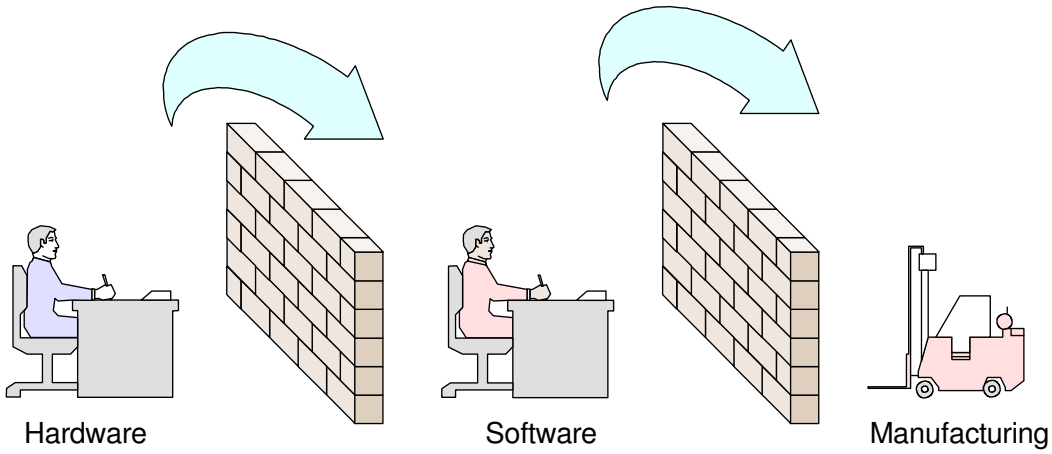
  When done, it passes their final design over the wall to the software group.

- Software looks at the hardware design and it doesn't really work for them.

  Software redesigns the hardware and then
  Writes the corresponding software.
  When done, they pass the final design over the wall to manufacturing.

- Manufacturing looks at the design and it really doesn't work for them either.

  Manufacturing redesigns the hardware and software so that the product can be built.



Total Quality Management in Senior Design

The idea behind TQM is to get the design right, right from the start.

Example: Pick a microcontroller and a programming language

- Pick one that everyone in your group can live with

Microcontroller:

- Has enough I/O pins
- SPI, SCI, I2C capable
- Bluetooth, WiFi supported
- Enough A/D, resolution of A/D

Software:

- Capable of interrupts
- Bluetooth / WiFi libraries exist
- Touch-screen libraries exist

The hope is that you won't need a redesign when you get to Design III

- Combine parts into a single device

Project Management in Design II and III

Use whatever method you like

As long as you complete the project under the constraints of

- Time,
- Budget, and
- Scope

you meet the expectations for Senior Design.

ECE 403: Homework for Week #2

Create a OneNote document

- One document per group

Set up sections

- Contact Information
- HW2: Project Charter

Set up pages within sections

Fill in content

Share

- With group members
- With instructors

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Note: Put time time into the list of tasks

- Brainstorm - come up with a list
- Really importnt
- Pretty much define the rest of the semester