

# ELE 491

## Senior Design Project Proposal

These slides are loosely based on the book Design for Electrical and Computer Engineers by Ford and Coulston. I have used the sources referenced in the book freely and without re-attribution. Please see the book for full source attribution



# **ELE 491**

# **Senior Design Project Proposal**

**Class 10 – Project Management**

# Project Management

## Overview

- Primary Objectives of Project Management
  - Complete projects that are:
    - On time
    - Within budget
    - Meet requirements

# Project Management

## WBS

- Work Breakdown Structure (WBS)
  - Definition of the work to be done
  - Timeline for activity completion
  - Resources needed
  - Person responsible
  - Dependencies (predecessors)
  - Checkpoints

# Project Management

## WBS

- Definition of the Work to be Done
  - Hierarchical
  - Typically tied to the system architecture
    - Tasks for each block
    - System integration
    - Test
    - Delivery
  - Task completion tied to system/block requirements (deliverables)

# Project Management

## WBS

- Timeline for Activity Completion
  - Start Dates
    - Fixed – based on external requirement
      - Personnel availability
      - Customer approval
    - Dependent – based on some deliverable from elsewhere in the WBS
  - Completion Dates
    - Completion of ALL deliverables
    - Can be set by external requirements
      - Equipment availability window
      - Personnel availability window
      - Project completion goals (market launch)

# Project Management

## WBS

- Resources Needed
  - People
    - What types
    - How many
    - How long
    - Who specifically
  - Equipment/tools
    - Capital equipment
    - Simulation tools
    - Components
  - Lead time consideration for both people and equipment

# Project Management

## WBS

- Person Responsible
  - Each task in the WBS may have many “people” resources tied to it but there should be **1 person** responsible for making sure the task is completed properly



# Project Management

## WBS

- Dependencies

- Each task should identify all the prior tasks that need to be completed prior to starting the task

- These may be tied to subtasks

- Example: VCO block design dependencies

Start

VCO requirements definition (frequencies, voltage ranges, ...)

Behavioral model for OpAmp (not the full opamp design)

Final Design

Full opamp design

# Project Management

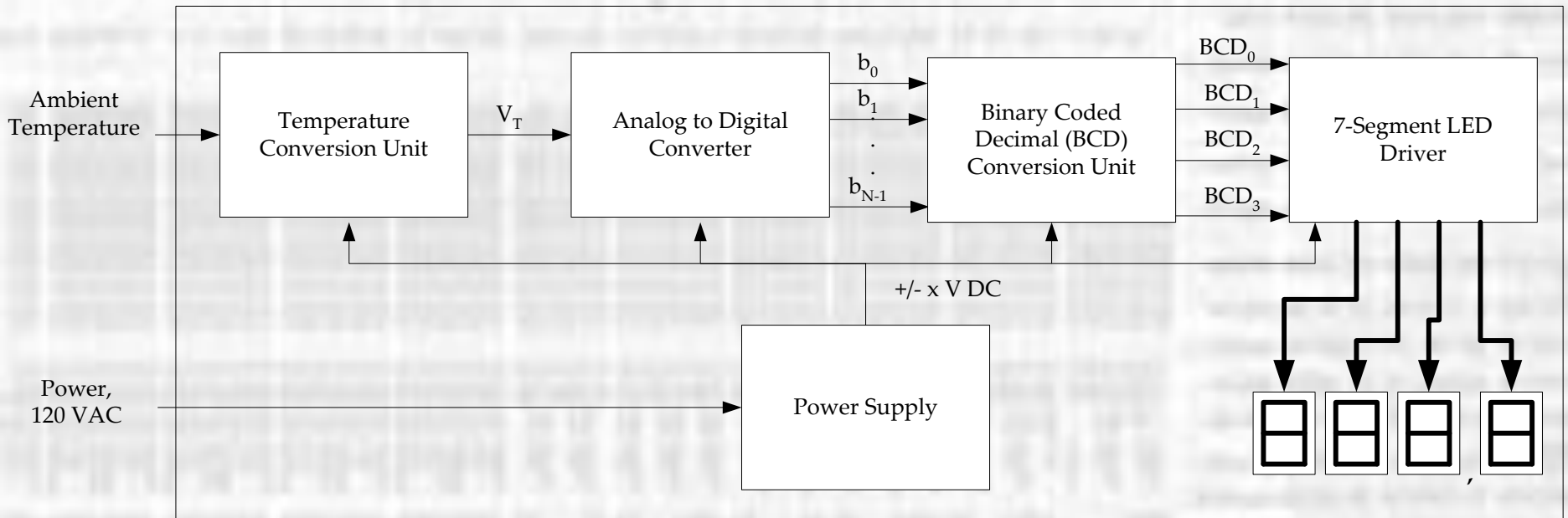
## WBS

- Checkpoints
  - Tasks that exceed a 1 week duration should have checkpoints built in to track progress
  - Tasks that involve multiple people should have checkpoints at transition points

# Project Management

## Example

Problem: Create the WBS for a temperature monitoring system design



# Project Management

## Example

- Thermometer design

There are three main tasks

1. The analog interface circuitry.
2. The LED & digital circuitry.
3. Integrate & Test.

# Project Management

## Example

- **Thermometer Design**
  - **Activity:** Design Circuitry
  - **Description:** Complete the detailed design and verify it.
  - **Deliverables/Checkpoints:** 1) Circuit schematic, and 2) Verify in simulation.
  - **Duration:** 14 days.
  - **People:** Jana (1), Rob (1)
  - **Resources:** PC, SPICE Simulator
  - **Predecessors:** none

# Project Management

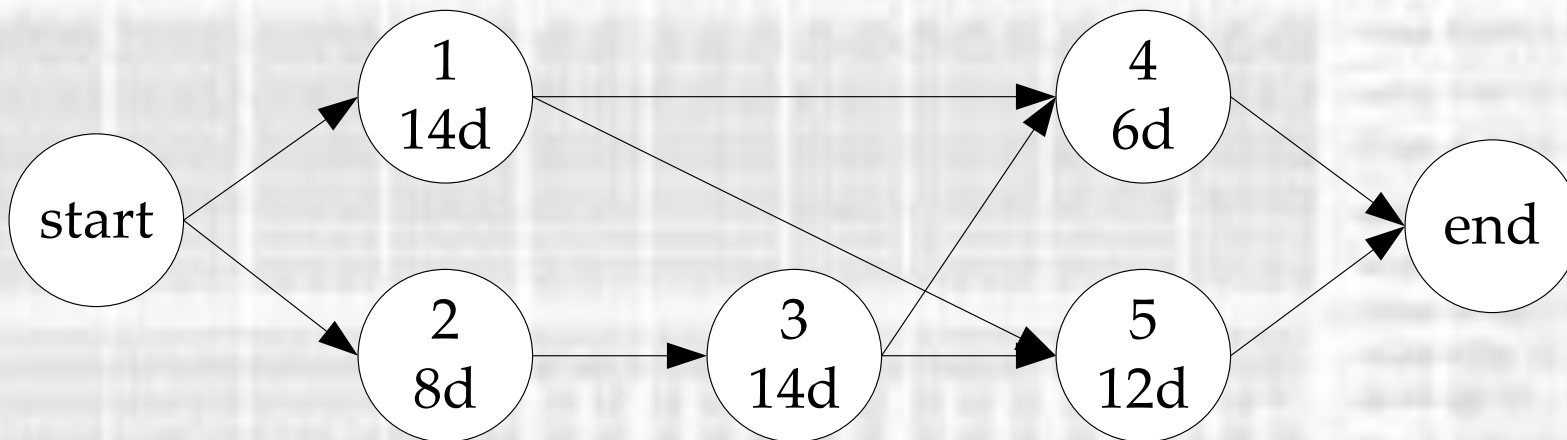
## Example

ID	Activity	Description	Deliverables / Checkpoints	Duration (days)	People	Resources	Predecessors
1	<b>Interface Circuitry</b>						
1.1	Design Circuitry	Complete the detailed design and verify it in simulation.	<ul style="list-style-type: none"> <li>• Circuit schematic</li> <li>• Simulation verification</li> </ul>	14	Rob (1) Jana (1)	<ul style="list-style-type: none"> <li>• PC</li> <li>• SPICE simulator</li> </ul>	
1.2	Purchase Components		<ul style="list-style-type: none"> <li>• Identify parts</li> <li>• Place order</li> <li>• Receive parts</li> </ul>	10	Rob		1.1
1.3	<b>Construct &amp; Test Circuits</b>	Build and test.					
1.3.1	Current Driver Circuitry	Test of circuit with sensing device.	<ul style="list-style-type: none"> <li>• Test data</li> <li>• Measurement of linearity</li> </ul>	2	Jana (1) Rob (2)	<ul style="list-style-type: none"> <li>• Test bench</li> <li>• Thermometer</li> </ul>	1.2
1.3.2	Level Offset & Gain Circuitry	Test of circuit with voltage inputs.	<ul style="list-style-type: none"> <li>• Test data</li> <li>• Measurement of linearity</li> </ul>	3	Rob (1) Jana (2)	<ul style="list-style-type: none"> <li>• Test bench</li> </ul>	1.2
1.3.3	<b>Integrate Components</b>	<b>Integrate the current driver and offset circuits.</b>	<ul style="list-style-type: none"> <li>• Test data verifying functionality and linearity requirement</li> </ul>	5	Rob (1) Jana (1)	<ul style="list-style-type: none"> <li>• Test bench</li> <li>• Thermometer</li> </ul>	1.3.1 1.3.2

# Project Management

## Time Management

- Critical Path(s)
  - The path through the WBS that takes the longest time
    - Mapping based on dependencies



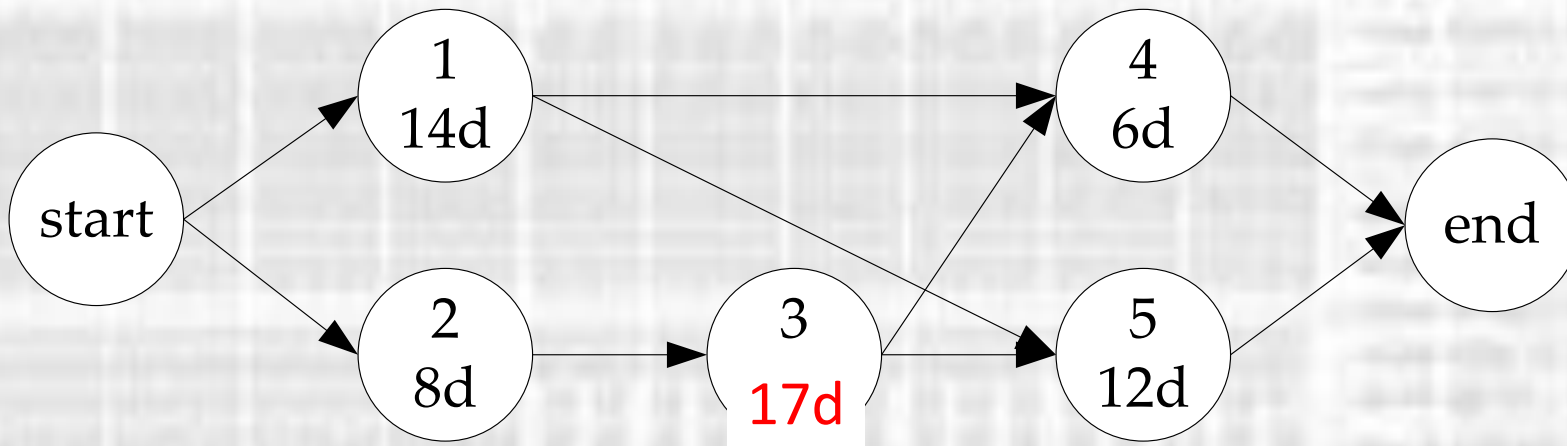
- A)  $S \rightarrow 1 \rightarrow 4 \rightarrow E = 20d$
- B)  $S \rightarrow 1 \rightarrow 5 \rightarrow E = 26d$
- C)  $S \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow E = 28d$
- D)  $S \rightarrow 2 \rightarrow 3 \rightarrow 5 \rightarrow E = 34d$

$$t_{CP} = 34d$$

# Project Management

## Time Management

- Slippage
  - Delays associated with any task
  - Slippage along the critical path causes overall program delays



- A)  $S \rightarrow 1 \rightarrow 4 \rightarrow E = 20d$
- B)  $S \rightarrow 1 \rightarrow 5 \rightarrow E = 26d$
- C)  $S \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow E = 30d$
- D)  $S \rightarrow 2 \rightarrow 3 \rightarrow 5 \rightarrow E = 36d$

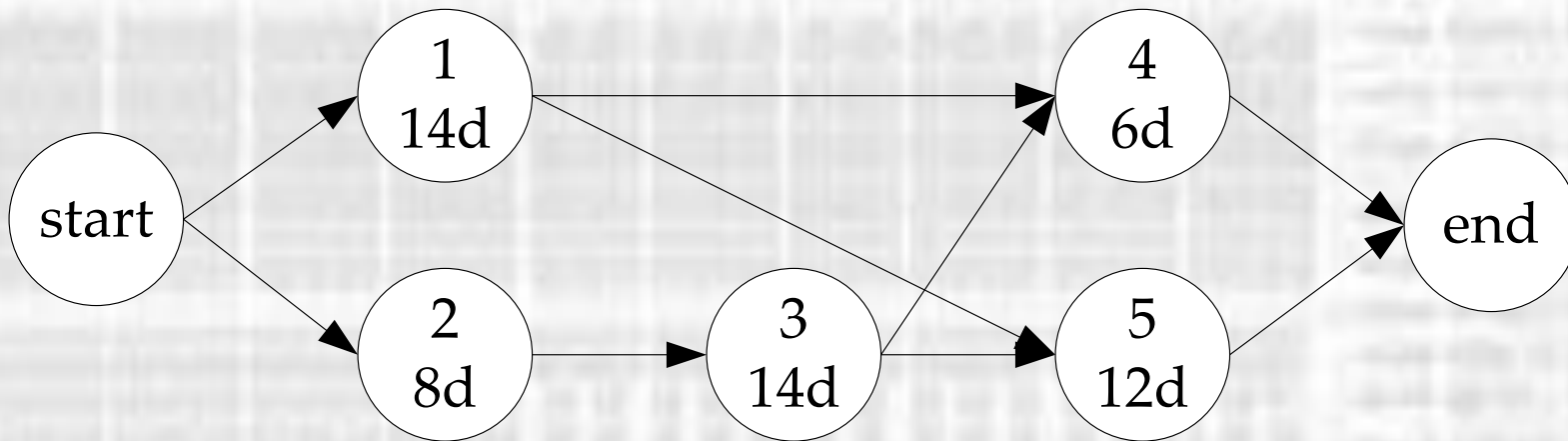
$$t_{CP} = 36d$$



# Project Management

## Time Management

- Slack (Float)
  - Excess or spare time available to tasks that are not on the critical path



A)  $S \rightarrow 1 \rightarrow 4 \rightarrow E = 20d$  -- Slack (1,4) = 14d

B)  $S \rightarrow 1 \rightarrow 5 \rightarrow E = 26d$  -- Slack (1) = 8d

C)  $S \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow E = 28d$  -- Slack (4) = 6d

D)  $S \rightarrow 2 \rightarrow 3 \rightarrow 5 \rightarrow E = 34d$

$t_{CP} = 34d$

# Project Management Tools

- Gantt Chart
  - Microsoft Project – available through “anywhere software”

Task Name	Start	Finish	Duration	Jan 2005		Feb 2005				
				1/16	1/23	1/30	2/6	2/13	2/20	2/27
<b>1: Interface Circuitry</b>	1/10/2005	2/22/2005	32d							
1.1: Design Circuitry	1/10/2005	1/27/2005	14d							
1.2: Purchase Components	1/28/2005	2/10/2005	10d							
<b>1.3: Construct &amp; Test Circuits</b>	2/11/2005	2/22/2005	8d							
1.3.1: Current Driver Circuitry	2/11/2005	2/14/2005	2d							
1.3.2: Level Offset & Gain Circuitry	2/11/2005	2/15/2005	3d							
1.3.3: Integrate Components	2/16/2005	2/22/2005	5d							
<b>2: LED &amp; Driver Circuitry</b>	1/10/2005	2/9/2005	23d							
2.1 Research A/D Converters	1/10/2005	1/10/2005	1d							
2.2 Complete Hardware Design	1/11/2005	1/19/2005	7d							
2.3 Purchase LED & Driver Components	1/20/2005	2/2/2005	10d							
2.4: Construct & Test	2/3/2005	2/9/2005	5d							
<b>3: System Integration &amp; Test</b>	2/23/2005	3/3/2005	7d							

# Project Management

## Cost Analysis

- Cost Elements - Manufacturing
  - Fixed – not dependent on the number of units produced (Capital)
    - Factories
    - Equipment
  - Variable – dependent on the number of units produced
    - Labor
    - Raw materials
    - Utilities – Energy, water, ...
    - Licensing

# Project Management

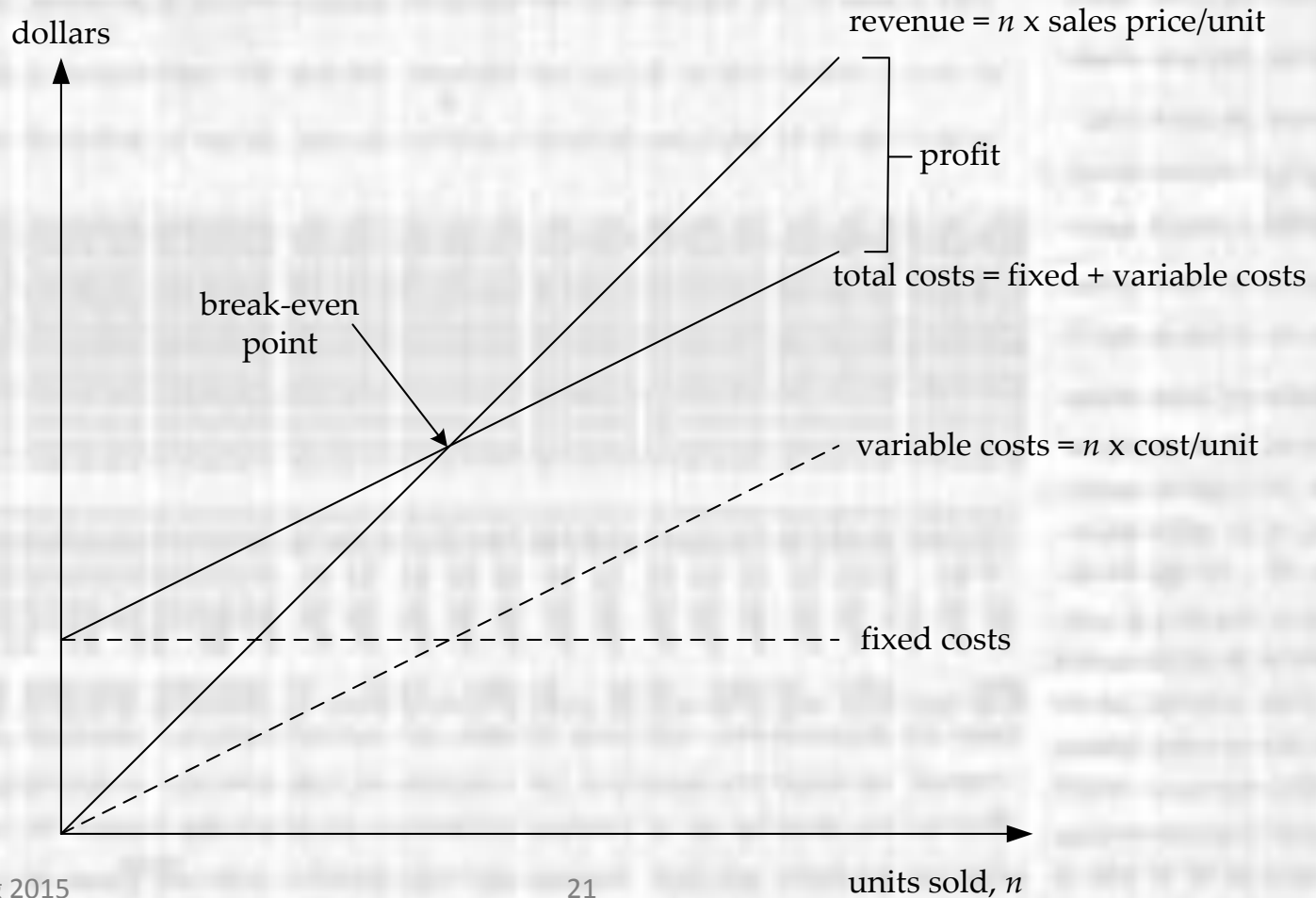
## Cost Analysis

- Cost Elements – Non-manufacturing
  - Development – Costs from concept to production
    - Design
    - Software
    - Test
    - Prototypes
    - Licensing
  - Overhead
    - Management
    - Marketing
    - Advertising
    - Taxes
    - Office space/equipment

# Project Management

## Cost Analysis

- Break Even Point



# Project Management

## Guidance

- Project Management is Guided by Experience
  - Build WBS after the system design is complete
  - Double all initial time estimates
  - Test/Integration take a lot of time
  - Factor in lead times
    - Parts, tools, boards, ...
  - Assign a project manager
  - Distribute assignments appropriately and equally
  - Track progress (weekly)
  - Be flexible but review plan changes with appropriate stakeholders

## In Class Activity