

EECE 404 – Senior Design II

Dr. Charles Kim

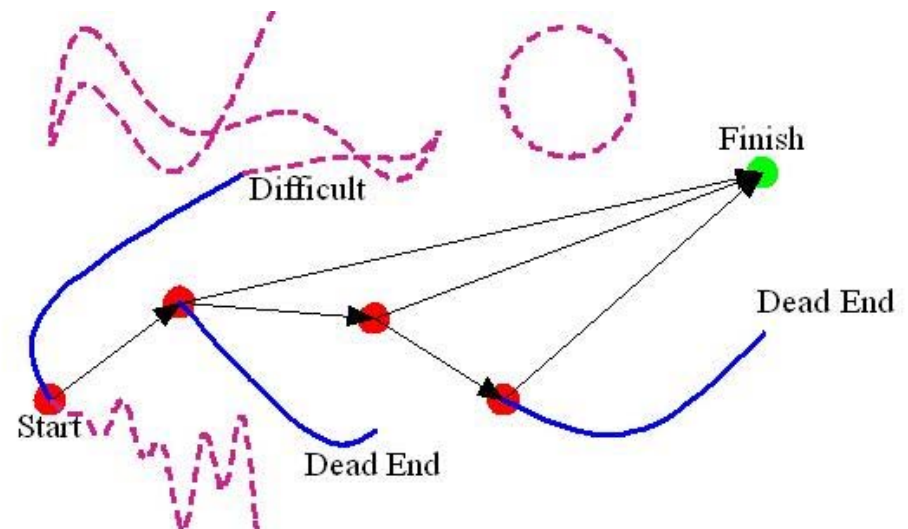
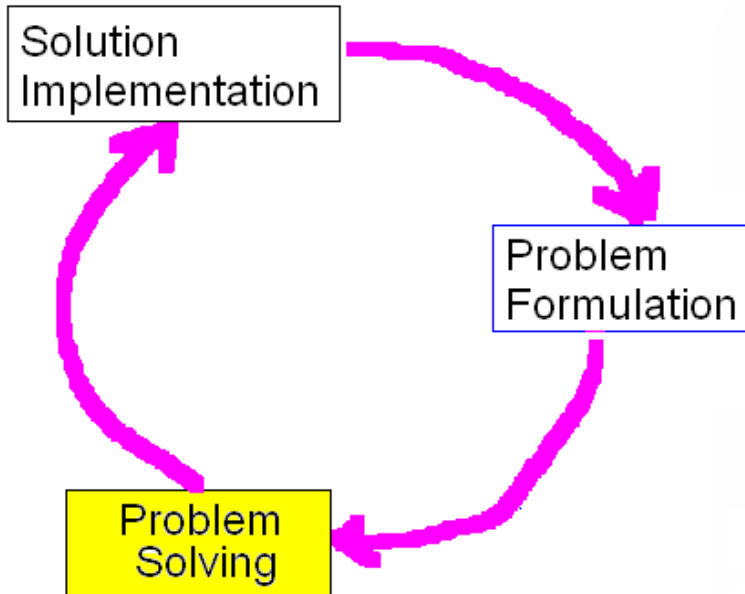
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Spring 2010

Focus of Spring Semester

- Solve the problem, quickly!
- Do it today!
- Design for Prototype or Demo kit
- Get the parts ASAP.
- Build, Test, rebuild, re-test, re-rebuild,...
- Write Progress Report and Present, many times.
- ECE Day – Final presentation on April 15

Problem Solving



•Objectives:

- The steps of problem solving
- Strategies for generating, analyzing, and selecting alternatives
- Making Progress

Class Schedule

–January: Solution Generation

- Alternative Solutions are merged into THE solution
- Progress Report & Presentation (W, Jan 27) (class)

–February: Implementation of the Project

- Implementation and Evaluation plan Presentation
- Implementation and Progress
- First ECE (Public) Progress Report Presentation (W, Feb 17)**

–March: Completion of the Implementation

- Completion of the implementation
- Progress Reports and Presentations (Class)
- Second ECE (Public) Progress Presentation (W Mar 31)**

•Final Project Presentation (ECE Day)

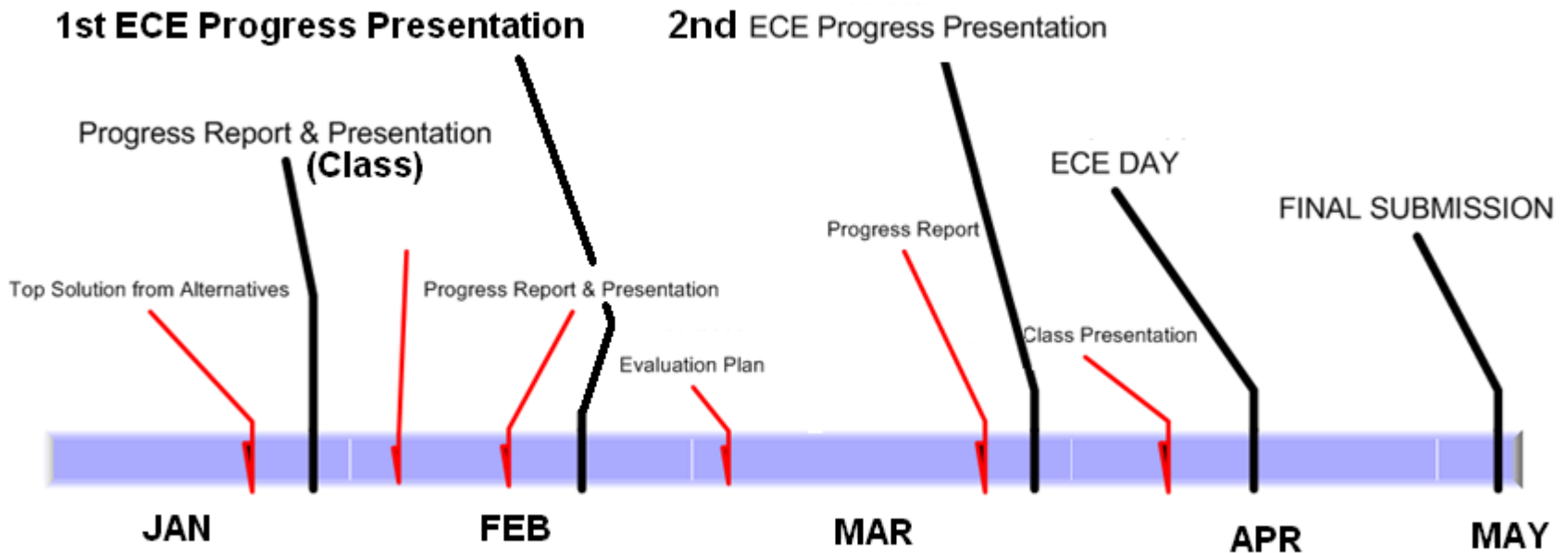
- Thursday, April 15, 2010
- Blackburn Center

•Class Policy

- More time to teams
- Progress Report Presentations

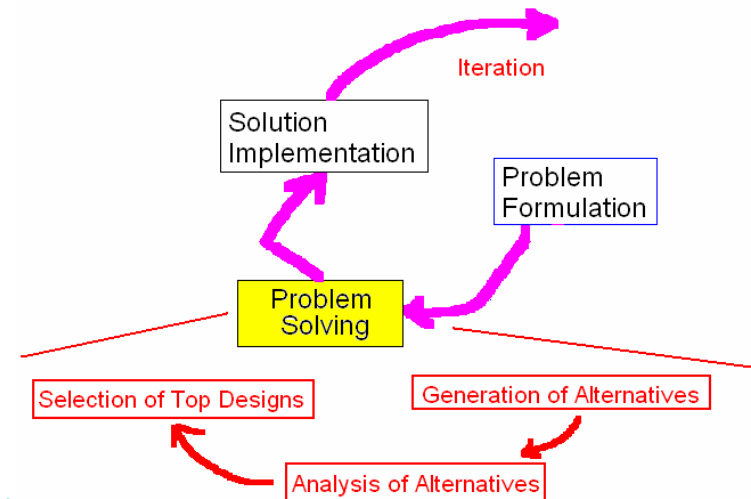
Milestones

- Selection of Top Solution
- Prototype Design
- Parts Order
- Familiarity with software tools and language
- Steady Progress



Solution Generation Process

- **Finding** design solutions to a well-understood problem --- **“Alternative Solution Generation”**
- **Exploring and Analyzing** those designs, and --- **“Analysis of Alternatives”**
- **Selecting** the most promising design for implementation --- **“Top Design”**



Step 1: Generation of Alternatives

- The act of expansion - all possible solutions
- Overcome the temptation to adopt the first idea
- Developing ideas individually and pooling them together generate more ideas
- Wide design space but true to the problem (functional requirements)
- Building onto existing solutions

Step 2: Analysis of Alternatives

- Screening
 - Remove those that do not meet the functional requirements (“concept screening”)
- In-depth analysis of final candidates
 - Modeling analytically with equations
 - Modeling with a simulation
 - Qualitative Reasoning

Analysis with Equations

- Key Tools
 - Use **equations** to model a design before building it
- Examples
 - **Cell Phone battery** : Prediction of battery life (electrical analysis)
 - **Airplane** : Prediction of Lift-to-Drag ratio (Fluid mechanics analysis)
 - **Power Plant**: Prediction of the amount of sulfur in the emission for different combustion process or fuel types (Chemical and Thermal Analysis)
 - **Database**: Prediction of MB needed for data storage (Software Analysis)
 - **Wireless Amplification**: Prediction of Signal Power for wireless transmission (Signal Analysis)
- Cautions
 - Equations are representations of reality, **not** reality itself
 - Example: Diode models

Analysis with Models and Computer Simulation

- When hand-derived equations are too complex
- Examples of Computer Simulation:
 - Fault Current Calculation
 - Torque Requirements
 - Magnetic Induction
 - Response Time
 - Temperature of computer chip for different cooling methods
 - Size for electrical component in a thermostat circuit used to turn on and off heating or cooling
 - Renewable Energy Generation
 - Demand Responses
- Weakness:
 - Assumption, restrictions, and limitations of computer simulation tools
 - You get what is modeled, not the reality

Analysis with Qualitative Reasoning

- Analysis with Expert Opinions
- Analysis with Customer Preferences and Requirements and specific circumstances
- Your advisor
- Your sponsor

Problems Observed

- The problems observed in the previous Senior Designs
 - No Serious Alternative Designs
 - Simulation for Simulation's Sake
 - No rigorous analysis for design comparison
 - No effort of designing a circuit
 - Instead, let Internet do for them
 - A purchased kit replaced the design
 - No evaluation of the design

3. Selection of Top Designs

- Selection is decision-making
- Decision-making involves making trade-offs
 - The results of the 3 types of analysis
 - Requirements from customer
 - Requirements of different importance
- Decision Tool
 - Decision Matrix

Using a Decision Matrix

- Step 1: Collect Information (Analyses)
- Step 2: Determine and Weight Attributes
- Step 3: Rate the Solutions
- Step 4: Rank the Solutions
- Step 5: Combine and Improve the Solutions
- Step 6: Resolve the Decision



		Bluetooth Development Boards							
		Teleca Comtec		Stonestreet One		GCT		Atmel	
Selection			Weighted		Weighted		Weighted		Weighted
Criteria	Weight	Rating	Score	Rating	Score	Rating	Score	Rating	Score
Price	40	4	1.6	3	1.2	1	0.4	1	0.4
Power	15	4	0.6	4	0.6	4	0.6	1	0.15
Software	35	2	0.7	4	1.4	3	1.05	2	0.7
Version	10	1	0.1	4	0.4	4	0.4	4	0.4
Total Score			3		3.6		2.45		1.65
Rank			2		1		3		4

Top design Selection

- How to prioritize and weigh the attributes
 - Not for convenience
 - Not toward the already-chosen direction
 - Toward true to the design requirements
- **Solution Generation Report & Presentation**
 - **Report** (Description of)
 - List Alternative Solutions
 - Analyze all the available solutions
 - Find decision matrix attributes
 - Prioritize and put weights on attributes
 - Top Design Selection
 - **DUE**: W JAN 27 (Hardcopy)
 - **Presentation**
 - 15 minutes of presentation time
 - PRESENTATION DATE: **W JAN 27**

First Class Activity

- Sketch of your intended (desired) ECE Day Demo Kit
 - Appearance
 - Functions
 - Connections
 - Etc
- >1 submission per team