SYST 101: Intro to Systems

Lecture 5

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Announcements

- You will be required to attend the final project presentations of SYST 490/495 on May 2, at 9:00 location TBD

- Lecture notes at:

  www.gmu.edu/departments/seor/syllabi/03B/SYST101/SYST101.htm

Agenda

- Topics for Today
  - Homework discussion
  - Assumptions and analysis

Homework Discussion

- Task consisted of 3 elements
  - Bend a paperclip (to redesign the GEM) and draw the resulting design
  - State the good and bad points of the design
  - State how you might test your claims

Homework Grading

- Indication that you bent a paperclip (if only in a thought experiment) as evidenced by a drawing   70 pts.
  - Would the design really work?   10 pts.
- Any honest discussion of the merits or weaknesses of the design   10 pts.
- Any plausible discussion of a possible test program   10 pts.

Not Looking For:

- Not looking for:
  - Marketing brochure
  - Unsubstantiated claims
  - New clasping methods
  - Impossible (implausible) solutions
  - extra features beyond utility to hold papers

- K.I.S.S.
  - Know what the job is
  - Minimum acceptable job, shortest time, least cost

Use The SE Process!

- <u>Conceive</u>
  - Understand the requirements
    - Read The Question
  - Assume a solution
    - Bend a paperclip and see if it works
    - Repeat if necessary

- <u>Build</u>
  - Write up the project
    - Good and bad points and a possible test procedure

- <u>Use</u>
  - Turn it in

Establishing Your Team

- You will need more communications and face time than you expected

- Grading criteria next time:
  - Robot performance
  - Oral presentation
  - Documentation package
  - Peer evaluations

Review

- Systems Engineers are a mile wide and a foot deep
  - Breadth encompasses the way system engineering works across the whole system
  - Depth encompasses some understanding of the elements of a system

- Your courses provide "experience" to use
  - SEOR courses describe the things and how system engineers do them across a system (breadth)
  - Other courses provide understanding of the elements (depth)

Conceiving a Solution

- Assume a solution
  - Based on the requirements
  - Based on knowledge / previous experience
    - Study widely

- Analyze the assumed solution
  - Fix what does not work well enough

- Repeat as necessary

Assumptions in Analysis

- Always starts with simplifying assumptions.

  - Solve the easy problem first, then add complicating factors and issues

- Always keep in mind your assumptions

  - You not really solving the real problem, you're solving something similar (you hope)

Analysis Difficulties

- You can never be sure when you are done
  - Understanding what is important
  - Unanticipated failure mechanisms
  - Unrealistic assumptions
- Mind set when performing analysis
  - Keep an open mind
  - Second set of eyes on the problem

Technical Areas

- Physics

- Chemistry

- Aerodynamics

- Materials

- Electrical / Electronics

- Information

- Dynamics

- etc.

Non-technical Areas

- Customer needs and utility
- Customer perceptions
- Aesthetics
- Personnel issues
- Ergonomics
- Socio-economic issues
- etc.

Assignments

- Reading
  - Petroski, Invention by Design, Chapter 3 "Pencil Points and Analysis"
  - Petroski, To Engineer is Human, Chapter 4 "Engineering as Hypothesis" and Chapter 5 "Success is Foreseeing Failure"

- Homework
  - Lego Mindstorm Tutorial
    - Install and run the software. Proceed through the tutorial. (completed by all team members by Thursday)

Homework (cont.)

- Consider the roads and parking lots of the GMU Fairfax campus as "the GMU Fairfax Traffic System".
  - One external element within the environment of the Traffic System (i.e., can affect and can be affected by) is listed below. List 4 more.
    - -- Local road & street network
  - One external element within the Context of the Traffic System (i.e., can affect the parking system but CANNOT be affected by it) is listed below. List 4 more.
    - -- the weather