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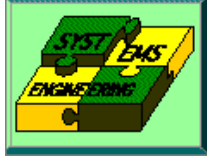

SYST 101: Intro to Systems

Lecture 23

Apr. 15, 2003

C. Wells, SEOR Dept.

Announcements

- Remaining Semester Schedule
  - Apr 17 lecture 24
  - Apr 22, 24 Project 2 demos and oral presentations
  - Apr 29, May 1 Review for final
  - May 2 SYST 490/495 presentations
  - May 13 Final Exam 10:30 – 1:15

Grading of Project 2

- Project Grade
  - Completion of the long course (track)
  - Completion of the short course (bounce off walls)
  - Documentation Package
  - Oral presentation
  - Weight is TBD
- Personal Performance Adjustment
  - Final Grade = Project grade x PPA
  - PPW is my assessment of your participation based on the lab notebook (weight is TBD)
- Team mates may not all get the same grade

Demo Schedule Apr 22

- Project 2 Demonstration Trials
  - 12:00 Team 1
  - 12:06 Team 2
  - 12:12 Team 3
  - 12:18 Team 4
  - 12:24 Team 5
  - 12:30 Team 6
  - 12:36 Team 7
  - 12:42 Team 8
  - 12:48 Team 9
  - 1:05 Team 1 Oral Presentation

Presentation Schedule Apr 24

- Project 2 oral presentations
  - 12:00 Team 2
  - 12:08 Team 3
  - 12:16 Team 4
  - 12:32 Team 5
  - 12:40 Team 6
  - 12:48 Team 7
  - 12:56 Team 8
  - 1:04 Team 9

Agenda

- Trouble shooting projects

Review of Key Points

- Three Step Process (or any other process of your choice)
  - Create
  - Build
  - Use
- Each step has a cycle
  - Formulate (guess)
  - Analyze
  - Interpret

Review (cont)

- Initially deal with models
  - actual entity doesn't exist yet
- Then make the entity
  - Evaluate how it works
- Trouble occurs when
  - Reality doesn't match the model
  - The model doesn't match reality

Why Doesn't It Work?

- The model is wrong
- The model is not sufficiently accurate
- The entity doesn't match the model
- The entity is broken

- So what's wrong, the model or the entity?
- What to you do about it?

Good vs. Bad Practitioners

- What makes a good auto mechanic?
- What makes a good doctor?
- What makes a good flight controller?
- What makes a good TV repairman?
- What makes good “street smarts”?

- What makes a good system engineer?
  - And why is this job harder?

The Secret Ingredient

- There is a critical modification to the cycle when comparing reality and a model
  - ***OBSERVE*** the operation of the entity
    - Note the differences between reality and the model
    - Identify the (possible) cause of the differences
  - Formulate (guess) a “solution” that addresses the causes for the differences
  - Analyze the solution
  - Interpret the analysis to see if the solution is adequate

Why?

- In order to make a better guess you need to understand the difference between the model's performance and the entity's
- To do this you need to understand what the model says it should do and what the entity does

- You have to observe the entity to understand what it is doing!

Quality of the Observation

- Sufficient detail to hypothesize what is causing the observed anomalous behavior
  - Why is it doing what it is doing
  - As usual, the needed quality of observation depends on the situation

Decide What is Wrong

- Are the anomalies caused by the wrong or an inaccurate model
  - You did document the model and the supporting assumptions didn't you?
- Did you build what you thought you were building?
  - You do have the plans and programs don't you?
  - You did follow the plans and programs didn't you?
- Is the entity broken?

Problems With New Stuff

- If it ever worked before, then something is broken now
  - What single “failure” could cause all (or most of) the anomalies
- If it never worked the question is whether it is broken, or could ever have worked at all
  - This is why engineering new things is harder

Observe – Think - Do

- Think before you make changes
  - Do you have a rationale for what caused the difficulties?
  - Does the “fix” address the cause?
  - Does the “fix” solve all the problems?
- Only then apply the fix
  - Document the fix
- Observe and document the results

Retest

- Note the last bullet on the previous slide
  - Observe and document the results
- After you change the model/entity you should retest the model/entity
  - Did the change work
  - Was the anomaly's cause mitigated
  - Were there other unanticipated changes
    - Pollyanna or Cassandra

And the Answer --

- Depends on the situation
- You have to cultivate the ability to observe accurately and adapt
  - Critical element of intelligence
  - Difference between academic exercise and real world engineering
    - observation → possible cause → improved solution
  - 30 years of experience or 1 year experience 30 times

Project 2 Example

- Tracking problem with white tape/lights against blue tape or pink panel background
  - Cause of anomaly? Fix?
- Different readings of blue and black levels close to and far from the lights
  - Cause of anomaly? Fix?
- Tracking 1-2” from the lights but on the white tape edge
  - Cause of anomaly? Fix?

Project 2 Example

- Caught in 90° corner
  - Cause of anomaly? Fix?
- Structural integrity problems
  - Cause of anomaly? Fix?
- Robots overshoot track and diverge
  - Cause of anomaly? Fix?
- Hang up on track
  - Cause of anomaly? Fix?
- Reverse course out of short track
  - Cause of anomaly? Fix?

Assignments

- Reading
  - Petroski, Chapters 6 & 7.
    - Facsimiles and Networks
    - Airplanes and Computers
- Homework
  - None. Focus on projects. Try to make a lot of progress this week.