Announcements

• Journal Check this week
• Assignment 4 due this week
• There is class Friday.
An Engineering Design Process

Client Need → Problem Definition

Conceptual Design

System-level Design

Detail Design

Design Communication → Final Design
We have a bunch of ideas.
Now what?
A Typical Approach

generate concepts
pick one
synthesize → analyze
improve
A: My best time is 10:00. Can you make it?

B: No, I can’t. How about 2:00?

A: Uh, already booked. Can you meet at 3:00?
An Alternative Approach

generate concepts

Look at sets of design ideas…

…and eliminate the worst.
(rather than pick the best)
A Set-Based Approach

• Now set up the meeting by communicating about sets.

A: I can meet 10:00 - 1:00 or 3:00 - 5:00. Can you make any of these times?

B: Let’s meet 12:00 - 1:00.
Design Convergence…

…isn’t usually smooth.
We also observe the following

- Identify Subsystems
- Configuration
- Interfaces

We also explore ideas here!
Controlled Convergence

1. Identify a good set of viable alternatives.
   - constraints

2. Identify evaluation criteria.
   - objectives
# Evaluation Matrix

<table>
<thead>
<tr>
<th>Criteria</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
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<td>d)</td>
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</table>
3. Choose a strong datum (or benchmark).

4. Rate the remaining alternatives
   + better than the datum
   - worse than the datum
   0 same as datum, or don’t know, or team disagreement

5. Eliminate alternatives if dominated by another
## Example

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>a)</td>
<td>+</td>
</tr>
<tr>
<td>b) Datum</td>
<td>-</td>
</tr>
<tr>
<td>c)</td>
<td>0</td>
</tr>
<tr>
<td>d)</td>
<td>+</td>
</tr>
</tbody>
</table>
Controlled Convergence, cont.

7. Develop remaining alternatives (e.g., system architecture)
   &
   Do more research / analysis
8. Incorporate combinations and new alternatives as they arise
9. Repeat
Variations

• Can make more robust by repeating evaluation using a different datum
  – look for consistency

• Can also use numerical scores instead of +/-/0 system
  – but only useful for rough rank ordering
  – avoiding using numerical scores to select an alternative!
Exercise

1. Get with your team.
2. Set up an evaluation matrix for concept design convergence.
3. Choose a datum.
4. Begin evaluation using +/-0/- system.