ECE 458
Engineering Software for Maintainability

Project Overview
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Meet your customer

- Large, industrial-scale food manufacturer
- Shelf stability group runs many hundreds of long-term food safety tests in parallel, currently managed via spreadsheet
- They want a system to organize everything
- Each team is a contractor vying for their business
Example shelf life test scenario

- If you’re making a cereal-based product, you might follow Cereal and Grain Association test methodology 35-01.01 “Guidelines for Shelf-Life Testing of Food and Ingredients for Key Quality Attributes”
  - **Source** (but you don’t have access); our private copy
- Figure 1 of this paper describes a sample experiment:

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<thead>
<tr>
<th>Condition</th>
<th>3</th>
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Fig. 1. Summary of a test protocol for a ready-to-eat (RTE) whole grain breakfast cereal.
Experiment design (1)

- An **experiment** involves a particular food
- Many samples of the food are procured and subjected to different **conditions** (temperature, humidity). Examples:
  - 0 F (frozen, the control group)
  - 70 F, 38% humidity (common storage environment)
  - 73 F, 50% humidity (summer storage environment)
  - 80 F, 65% humidity (tropical shipping conditions)
  - 100 F, 20% humidity (arid shipping conditions)
  - 70 F / 90 F cycling, 65% humidity (day/night effects, tropical)
Experiment design (2)

- At various **time points**, samples are pulled and subjected to one or more **assays** (tests). These may be:
  - **Sensory**
    - Trained human taste testing, usually comparing a test condition against the 0 F frozen control condition
    - Result is rating on a 1-5 scale of difference: 1=same as frozen (good), 5=extremely different (bad)
  - **Chemical**
    - Laboratory test looking for a particular attribute
    - Examples: hexanal presence (measure of rancidity), moisture penetration, more
    - Result is a number with some kind of physics units (e.g. ppm)
### Experiment design (3)

- Experiment designs call for different assays of the different conditions at different timepoints. For example:

#### Standard Storage Study Protocol

**RTE Cereal**

**Time of Sample Pull (Weeks)**

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**Total Number of Samples Required per Variant is 52**

#### Specific assays

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The software problem

• Experiments take many months to complete, and *many* are going on simultaneously.

• The customer is currently using a bunch of spreadsheets, but is having trouble keeping track of all the experiments

• Key goals for the software we’ll be building:
  • **Starting experiments**: how many samples in what conditions?
  • **Managing experiments**: What experiments are going on, when samples need to be pulled, what assays they need, etc.?
  • **Getting data**: Recording the results of these assays
  • **Generating conclusions**:
    • Generating spreadsheets of the results for analysis by food scientists
    • Generating written reports that identify trends, shelf life projections, etc.