Assignment 02 solution summer 2015

1. **(20 points) Experiment 1:**
    1. Factors: Fixture, Layout, Operator
    2. Factor Levels: 3 Fixed levels of Fixture; 2 Fixed levels of Layout; 4 Random Operators
    3. Treatments: 24 Treatments consisting of a cross of Fixture by Layout with Operator nested within Layout and Fixture
    4. Response: Average time to assembly circuit board
    5. Experimental Units: Circuit board
    6. Measurement Units: Circuit board
    7. Replications: Two circuit boards
    8. Subsampling: None
    9. Covariates: None
    10 Blocking: None
    11. Confounding: None but Location and Layout could be considered to be confounded

C1. Method of Randomization: Completely Randomized Design

C2. Treatment Structure: Fixture crossed with Layout with Operator nested within Layout and Fixture

C3. Measurement Structure: One measurement on each of the 48 circuit boards

2. **(20 points) Experiment 2:**
    1. Factors: Insect Infestation; Weed Species; Clipping
    2. Factor Levels: 4 Fixed levels of Infestation; 3 Fixed levels of Weed Species; 2 Fixed levels of Clipping
    3. Treatments: 24 treatments consisting of a crossing of Infestation, Weed Species, and Clipping
    4. Response: Yield of cotton for each subplot
    5. Experimental Units: Field for Infestation; Plot for Weed Species; Subplot for Clipping
    6. Measurement Units: Subplot
    7. Replications: Two subplots per Infestation-Weed Species-Clipping combination
    8. Subsampling: None
    9. Covariates: None
    10 Blocking: None
    11. Confounding: None

C1. Method of Randomization: Complete Randomized Design with a Split-Split Plot treatment assignment

C2. Treatment Structure: Whole plot treatment-Infestation; Split plot treatment-Weed species;Split-split plot treatment-Clipping

C3. Measurement Structure: One measurement on each of the 48 subplots

3. **(20 points) Experiment 3:**

    1. Factors: Sweeteners; Leavening Agents
    2. Factor Levels: 3 Fixed levels of Sweeteners; 2 Fixed levels of Leavening Agents; 6 Random Tasters; 6 Random Orders; 3 Random Days
    3. Treatments: 6 treatments (recipes) consisting of a crossing of Sweeteners by Leavening Agents
    4. Response: Taste evaluation score
    5. Experimental Units: Cake
    6. Measurement Units: Sample of Cake
    7. Replications: 1 cake per recipe per day
    8. Subsampling: Sample of cake
    9. Covariates: None
    10 Blocking: Day, Taster, Order nested within Day
    11. Confounding: None

C1. Method of Randomization: A Randomized Complete Block - Latin Square Design (or Crossover Design) with Blocking variables, Days, Tasters, Orders

C2. Treatment Structure: A cross of Sweetener by Leavening Agent

C3. Measurement Structure: A taste rating of a sample of cake on a given Day by a given Taster

4. **(20 points) Experiment 4:**

    1. Factors: Instructor; Assessment Method; Period
    2. Factor Levels: 4 Random levels of Instructor; 3 Fixed levels of Assessment Methods; 3 Random levels of Period
    3. Treatments: 12 treatments consisting of a cross of Instructor by Assessment Method
    4. Response: Score on Exam
    5. Experimental Units: Student
    6. Measurement Units: Student during one of the three testing periods
    7. Replications: 6 students for each combination of Instructor by Assessment Method in a given Period
    8. Subsampling: None but each student is observed under each Assessment Method so there is Repeated measurements (3 per student)
    9. Covariates: None
    10 Blocking: None
    11. Confounding: None, except it could be stated that Instructor and Section are confounded

C1. Method of Randomization: This is a Crossover Design with each student observed under each of the Assessment Methods

C2. Treatment Structure: A cross of Instructor by Assessment Method

C3. Measurement Structure: 3 observations per EU (Student) - one from each Assessment Method for each student

Part II - Selecting the Design

5. **(20 points)**

D1. Randomly assign 6 aquaria to each of the 6 Temperature-Salinity Combinations. Then randomly assign the two Density levels to a partition within each of the 36 aquaria with a new randomization for each of the 36 aquaria. This is a split plot design. The aquaria would next be arranged in a 6×6 grid in a Latin Square Design in the room used for the experiment so that the 6 Temperature - Salinity levels are "equally distributed" about the room.

- Advantages: There will be more experimental units for comparing the two levels of Density compared to Design 2.
- Disadvantages: A somewhat more complex arrangement within the aquaria in comparison to Design 2.

D2. Randomly assign 3 aquaria to each of the 12 Temperature-Salinity-Density Combinations in a Completely Randomized Design. The aquaria would next be arranged about the room so that the 6 Temperature - Salinity levels are "equally distributed" about the room.

- Advantages: Design 2 is a more straightforward design with the split plot complications that are present in Design 1.
- Disadvantages: There are fewer EU's for the evaluation of the two Density levels in comparison to Design 1.