STA 674

Regression Analysis And Design Of Experiments

Basic Principles of Experimental Design – Lecture 1

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Introduction to Comparative Experiments

- Where does it fit in?
- What is it?
- Where next?

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How is data collected?

- **Observational Study**: A study in which **nature** assigns the controls the circumstances to each run of the experiment and the experimenter observes the response.
- **Comparative Experiment**: A study in which the **experimenter** controls the circumstances to each run of the experiment and then observes the response.

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Example – Assessing the Effect of Fertilizer on Crop Yield

- You plan to conduct an experiment to test the effect of fertilizer on the yield of agricultural crops.
- What do you need to know to design your experiment?

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1. **What is/are the question/s you want to answer?**
2. **What variables will you modify?**
3. **What values of the variables will you test?**
4. **What are your subjects?**
5. **How many subjects will you need?**
6. **How will you assign these variables to the subjects?**
7. **What response will you measure?**

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Terminology

- **Hypotheses**: The research hypotheses should determine the design of the experiment.
- **Factor**: A factor is a quantity whose condition (level) varies during the experiment.
- **Treatment**: A treatment is a single combination of levels from each factor.

  The number of possible treatments is the product of the number of levels from all factors.

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Experimental Units and Observational Units

- **Experimental units** are the units (things) to which treatments are assigned.
- **Observational units** are the units (things) from which the response is measured..

THese are often the same thing...but not always

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Example

- A researcher conducts an experiment to compare the effect of two different diets on two species of fish (goldfish and silverfish). The experiment is conducted as follows:

  1) Five goldfish and five silverfish are put in each of 2 tanks. 5 gold & 5 silver in tank 1...5 gold & 5 silver in tank 2

  2) For 10 weeks the fish in Tank 1 are fed diet 1 and the fish in Tank 2 are fed diet 2.

  3) At the end of the experiment the growth of each fish is measured and compared.

- Is this an observational study or a comparative experiment? experiment
- What are the factors? 1. species of fish (5 gold, 5 silver). 2. Diet & Tank (diet 1 in tank 1, diet 2 in tank 2)
- What are the treatments? 4 treatments total - goldfish in diet/tank 1, goldfish in diet/tank 2, silverfish in diet/tank 1, silverfish in diet/tank 2
- What are the experimental units? the tanks - the treatments are assigned to the tanks
- What are the observational units? each fish - the growth of each fish is measured/the response