Week 2

Monday, 30 October 2023 9:19 AM

Question 1 : Identifying population parameters and sample statistics.

Assign the correct symbols to the numbers given for both the scenarios below.

1. In a random sample of 30 people, 7% were left handed. Around 10% of people are left handed.

Population parameter

$p = 10\%$

Sample statistic

$\hat{p} = 7\% = \frac{7}{100} = 0.07$

$n = 30$

percentage: 10%

fraction: $\frac{10}{100}$

decimals: 0.10 ✓

Sampling → choosing a sample from population

Simple random sampling (SRS)	At a basic level, this method involves pulling names out of a hat. Though in practice, technology and random digits are usually used. All members of the generated sample are chosen at random and have the same chance of being in the sample. Each sample of a given size has the same chance of being chosen as every other sample of that size.

Systematic random sampling	The first member of the sample is chosen at random then the other members of the sample are taken at fixed intervals after that. E.g. to select 100 people from a list of 5000 people, randomly choose the first person from the first 50 names, then select every 50th person from that person.

→ List of all the people

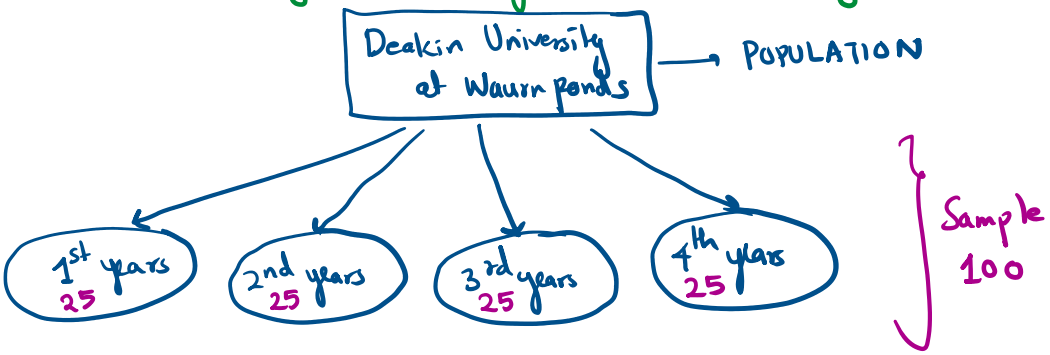
→ have a SYSTEM to select Sample

Stratified random sampling	Relevant subgroups (strata) from within the population are identified and random samples are selected from within each strata. For example, divide a population of students into males and females, and randomly sample from each gender.

→ Creating groups

→ randomly selecting people from each group

Example: Survey on Sports facilities at University



Cluster sampling	The population is divided into groups (for example geographically), then at least one of the groups is randomly selected and usually a census is conducted in the chosen group(s).

→ Creating groups

→ Select few groups and all people in that group.

→ Creating groups

→ Select few groups and all people in that group.

Example: Survey on Sports facilities at University

Question 3 : Identifying sampling methods

Consider the methods below for sampling passengers on a particular flight.
Name the method that has been used for each option.

1. Pick every 10th passenger on the passenger list — SYSTEMATIC SAMPLING
2. Randomly choose a number of passengers from first class as well as from economy — STRATIFIED SAMPLING
3. Randomly generate seat numbers and only survey the passengers sitting in those seats — SIMPLE RANDOM SAMPLING
4. Randomly choose a seat position (eg window, centre or aisle) and survey all the passengers in that position — one group → CLUSTER SAMPLING
5. Email all the passengers and ask them to complete an online survey — VOLUNTEER SAMPLING

a) A researcher want to select a sample of cats with a particular medical condition for trials of a new drug. From a list of all vet clinics, a particular clinic is selected from random and all the cats from that clinic with the condition are used in the trial. Which option best describes the sampling method? (1 mark)

- ○Volunteer
- ✓Cluster
- ○Simple Random
- ○Stratified
- ○Systematic

b) A researcher want to select a sample of cats with a particular medical condition for trials of a new drug. The researcher leaves information flyers at all the local vet clinics asking cat owners to respond if they are interested in their pet participating. Which option best describes the sampling method? (1 mark)

- ○Stratified
- ○Simple Random
- ○Systematic
- ○Cluster
- ✓Volunteer

Observational Studies

- Because researchers first identified patients of interest and then examined data on their existing/past records, this was a retrospective study.
- Had the researchers identified subjects in advance and collected data as events unfolded, the study would have been a prospective study.

Question 6 : Observational study

Heart attacks and height Researchers who examined health records of thousands of males found that men who died of myocardial infarction (heart attack) tended to be shorter than men who did not.

a) Is this an experiment? If not, what kind of study is it? Retrospective observational study

b) Is it correct to conclude that shorter men are at higher risk of dying from a heart attack? Explain.

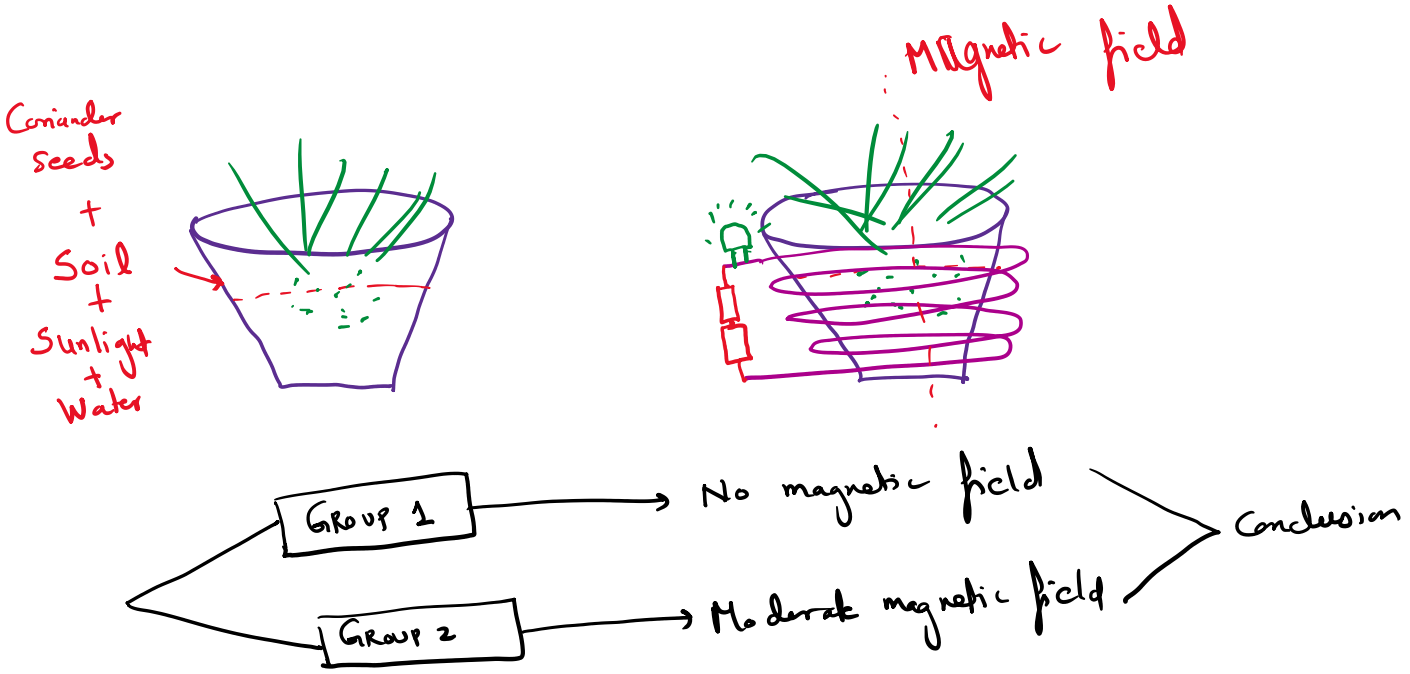
It is not correct to conclude as observational studies don't give cause and effect results, they only provide possible trends.

Experiments

- An experiment is a study design that allows us to prove a cause-and-effect relationship.

CONTROL

EXPERIMENT



1 FACTOR → Magnetic field

2 levels → Moderate magnetic field and no magnetic field

Question 7 : Experiment

Read brief report of statistical research, and identify:

a) whether it was an observational study or an experiment. Experiment because treatment was given

b) the subjects studied. people with bipolar disorder

c) the factor(s) in the experiment and the number of levels for each. 1 FACTOR → DIETARY SUPPLEMENT (HIGH DOSE ← → No dose); 2 LEVELS

d) the number of treatments. 2

e) the response variable measured. Improvement in the conditions

f) the design (completely randomized, blocked, or matched). No information provided

g) whether it was blind (or double-blind). PLACEBO means Single blind

h) the nature and scope of the conclusion the experiment can reach. Maybe change in dose (higher than 775mg/day or Lower dose) shows improvement

A : Over a 4-month period, among 40 people with bipolar disorder, patients who were given a high dose (775 mg/day) of a certain dietary supplement improved more than those given a placebo. → No dose

B : Some people claim they can get relief from migraine headache pain by drinking a large glass of ice water. Researchers plan to enlist several people who suffer from migraines in a test. When a participant experiences a migraine headache, he or she will take a pill that may be a standard pain reliever or a placebo. Half of each group will also drink ice water. Participants will then report the level of pain relief they experience.

Question 7 : Experiment

Read brief report of statistical research, and identify:

a) whether it was an observational study or an experiment. Experiment because treatment was given

b) the subjects studied. people with migraine headache

c) the factor(s) in the experiment and the number of levels for each. 2 FACTORS → PILL and Water temperature

✓d) the number of treatments. 4 (GROUPS)

e) the response variable measured. improvement in condition

f) the design (completely randomized, blocked, or matched). No information given

g) whether it was blind (or double-blind). blind only for medication

h) the nature and scope of the conclusion the experiment can reach. Checking for improvements to change treatment levels

medication → PILL: level 1 dose given; level 2 No dose

Water temperature: level 1 ice water; level 2 regular water

2 levels × 2 levels = 4

Group 1 → Pill + Ice water

Group 2 → Pill + regular water

Group 3 → No Pill + Ice water

Group 4 → No Pill + regular water

Dogs suffering with kidney disease were randomly assigned to diets differing in protein and moisture to see if any diet was more effective in slowing the progression of the disease and allowing the dog to live longer. Measurements of serum creatinine, blood urea nitrogen, potassium and calcium were made before and after the dogs followed the diet for three months. The dogs were assigned to a protein level diet (13%, 15% or 18%) with half of each protein group given canned food and the other half given dry food.

a) Is this an observational study or an experiment? (1 mark)

✓ ○Experiment, since the dogs were deliberately assigned to different treatment groups

○Experiment, since only the life expectancy was observed ✗

○Prospective, observational study because the dogs were observed on different diets ✗

○Retrospective, observational study because there is no control group ✗

○Observational study, since the disease progression was observed ✗

b) Identify the factors in this study, and the levels of each. (1 mark)

○protein (3 levels) and moisture (1 level)

○protein and moisture (1 level each)

○serum creatinine, blood urea nitrogen, potassium and calcium (1 level each)

○protein (2 levels) and moisture (2 levels)

✓ ○protein (3 levels) and moisture (2 levels)

c) How many treatments are there? (1 mark) 3×2=6

- ✓ 6
- 2
- 3
- 5
- 4

Protein → 13%, 15%, 18%

Moisture → Canned, Dry

I → 13% + Canned
II → 13% + Dry
III → 15% + Canned
IV → 15% + Dry
V → 18% + Canned
VI → 18% + Dry

d)Which statement best reflects the design of the study? (2 marks)

- randomised, blocked and matched ✗
- randomised and placebo controlled ✗
- randomised and double blind ✗
- completely non randomised ✗
- ✓ randomised and not known if it was blind to those evaluating the results

e)In the context of the 5W's, which option best describes the 'Who'? (1 mark) Subjects / experimental units

- Serum creatinine, blood urea nitrogen, potassium and calcium measurements and diet
- People administering the diets
- Researchers
- ✓ Dogs
- People recording the results