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7. Two Sample vs. One Sample Tests

Two Sample vs. One Sample Tests

1/1 point (graded)

A **one-sample test** is a hypothesis test where an unknown parameter μ is to be compared to a known reference value. For example, the U.S. heights example was a one-sample test because we wanted to compare the unknown mean μ from 2018 to the known average height from 2012, which was 5.5.

A **two-sample test** is a hypothesis test where two unknown parameters are compared to each other. For example, the clinical trial example is a two-sample test because we want to compare the unknown μ_{drug} to the unknown μ_{control} to quantify the drug effect.

Which of the following is a two-sample hypothesis testing question? (choose all that apply)

- [ ] Recall the kiss example of Unit 1. The question is: **Do the majority of people turn their head to the left or right?**.
- [ ] We collect data in a college. We find that out of 824 sampled students, 487 prefer nacho cheese flavored chips and 337 prefer the cool ranch flavor. The question is: **Do students prefer nacho cheese or cool ranch?**

☑ James has to choose between two routes to go to work: either by the subway or by the bus. To decide he samples 112 persons at his workplace who also live in the same neighborhood as him and asks them for two pieces of information: (1) method used to commute AND (2) commute time. He will use this data to answer the question: **Is it faster to travel to work by the bus or by the subway?**.

✔

Solution:

We examine the choices in order.

- "Recall the kiss example of Unit 1. The question is: **Do the majority of people turn their head to the left or right?**." is incorrect because it is a one-sample test. Namely, we treat turning to the right as 1 and turning to the left as 0, and we modeled this as $\mathrm{Ber}\,(p)$ for some unknown parameter p. Then we can rephrase the above question as: "**Is** $p > 1/2$ **OR is** $p < 1/2$ **?**". Hence, $1/2$ takes the role of the reference value, and we are only one unknown parameter is involved, so this is indeed a one-sample test.

- "We collect data in a college. We find that out of 824 sampled students, 487 prefer nacho cheese flavored chips and 337 prefer the cool ranch flavor. The question is: **do students prefer nacho cheese or cool ranch?**" is incorrect because it is a one-sample test. If we encode preferring nacho cheese flavor as 1 and preferring cool ranch as 0, then we can model this as a Bernoulli random variable, just like in the kiss example. You are encouraged to fill in the details to show that this is a one-sample test. (e.g. what is the reference value?)

- "James has to choose between two routes to go to work: either by the subway or by the bus. To decide he samples 112 persons at work who live in the same neighborhood as him and asks them for two pieces of information: (1) method used to commute AND (2) commute time. He will use this data to answer the question: **Is it faster to travel to work by the bus or by the subway?**." is correct because it is a two-sample test. The two unknown parameters of interest are μ_{subway}, the average commute time via subway, and μ_{bus} the average commute time via bus. We can rephrase the above question as: "**Is** $\mu_{\text{bus}} > \mu_{\text{subway}}$ **OR is** $\mu_{\text{subway}} > \mu_{\text{bus}}$ **?**". Indeed this is a two-sample test.

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