

PSYCH 10 · Fall 2026 · Worksheet for Lecture 2: Sampling & measurement · Answer key

The answers are in blue. Where a question has more than one defensible answer, the key says so and describes what a good answer contains.

Part 1 · Before and after the globe toss

We’re about to toss this globe around the room. If you catch it, look at where your right thumb landed, toss the globe on to someone else, and come to the front of the room: the corner on your left if your thumb was on water, the corner on your right if it was on land.

- a. Your prediction: what fraction of catches will be “water”?
- b. Name one thing that could make this process *biased*, meaning it would give us the wrong answer even after hundreds of tosses.
a. Any prediction is acceptable here; the point is to have one written down ahead of the data. Most people guess somewhere between 50% and 80%, and the actual fraction of the Earth’s surface covered by water is about 71%.
b. Something that would push the result in one direction regardless of the number of tosses: a globe whose printed oceans aren’t drawn to scale; hands that tend to land on the band around the equator, which is mostly water; a thrower who aims at a particular person or turns the globe the same way each time. A reason the result would wander around 71% from toss to toss, such as a small number of catches, is variation rather than bias.
- c. Our class result: _____ water out of _____ catches. Is that closer to your prediction or to the real answer (about 71%)? Write one sentence on why our class result might differ from the real answer.

(The class result goes here.) With a few dozen catches, a result several percentage points away from 71% is what sampling variation alone would produce, so a modest gap is not evidence of a biased process, while a large gap, or the same gap again on another day, would be a reason to suspect bias. In Fall 2025 the class got about 79% water after about 40 catches, which is within what chance would produce, though the hands-near-the-equator idea from b would push the result in that same direction.

Part 2 · Kinds of variables

For each variable below, decide whether it is **quantitative** or **categorical**, then which of the four levels it is: **nominal**, **ordinal**, **interval**, or **ratio**. Say why in a few words.

- 1. Bedtime last night (for example, 11:30 pm)
- 2. Finishing place in a 5K (1st, 2nd, 3rd, ...)
- 3. Course number (PSYCH 10, PSYCH 250)
- 4. Earthquake magnitude (for example, 4.5)
- 5. Birth year

	Quantitative or categorical?	Nominal, ordinal, interval, or ratio?	Why (a few words)
1	<i>quantitative</i>	<i>interval</i>	<i>a time point, so differences between bedtimes are amounts, but the zero point (midnight) is an arbitrary one rather than a true zero; and the clock wraps around, so 11 pm and 1 am are two hours apart even though their naive average is noon</i>
2	<i>categorical</i>	<i>ordinal</i>	<i>the order is meaningful but the gaps are not amounts: 1st to 2nd could be a second or ten minutes, and the amounts live in the finishing times</i>
3	<i>categorical</i>	<i>nominal</i>	<i>a label: the hundreds digit hints at the level, but PSYCH 250 is not 25 times PSYCH 10, and nobody averages course numbers</i>

	Quantitative or categorical?	Nominal, ordinal, interval, or ratio?	Why (a few words)
4	<i>quantitative</i>	<i>interval</i>	<i>equal steps on the scale are meaningful, but each whole step is about 32 times the energy and 0 is not "no earthquake," so a 6.0 is not twice a 3.0</i>
5	<i>either</i>	<i>interval as a year; nominal as a cohort</i>	<i>differences between years are amounts (born three years apart) and year 0 is not "no birth"; used only to label a cohort (the class of 2028), it is a category</i>

Suppose the class survey from earlier recorded chronotype as 1 = lark, 2 = owl, and a friend averages the column and gets 1.6. "So the class is more owl than lark," they say. **True or false?** Justify your answer in one or two sentences, using what the numbers mean. Would your answer change if the survey had also offered 3 = neither?

True as stated, for a reason that uses what the numbers mean. With only two labels, 1 and 2, the mean of the column is 1 plus the fraction of owls, so a mean of 1.6 says that 60% of the class picked owl; the mean is a disguised proportion rather than an amount of owl-ness. The answer would change if the survey had also offered 3 = neither: a mean of 1.6 could then come from 70% larks and 30% "neither" with no owls at all ($0.7 \blacksquare 1 + 0.3 \blacksquare 3 = 1.6$), or from many other mixes, so the mean no longer says which group is biggest, and the summary that makes sense is the count or proportion in each category.

Part 3 • A surprising survey result

Suppose a campus-wide survey run by *The Stanford Daily* found **far fewer first-generation students than the admissions office reports**.

a. List **three different processes** that could have produced this result. Make them different from one another, not variations on one explanation.

b. Circle the one you find most plausible.

c. Pick one of the others. What data, existing or new, would help you tell that process apart from the one you circled?

1. *The people who answered: a Daily survey reaches Daily readers, people on a particular mailing list, and people with time to fill it in, rather than a random draw of enrolled students, and first-generation students may be less likely to be in that group.*

2. *The definition of "first-generation": the survey's wording (no parent with a bachelor's degree? no parent who attended any college? parents educated outside the US?) may not match the admissions office's definition, so the two numbers are counts of different things.*

3. *The populations behind the two numbers: admissions may report the entering class while the survey reached students across all years, or undergraduates and graduate students together, so the two percentages describe different groups of people.*

c. *Any of the three can be circled with a reason, and the first (who answered) is usually the strongest candidate; two more candidates are students declining to identify themselves on a survey that isn't anonymous, and chance, if the survey was small. To tell selection from a definition mismatch: compare the respondents' mix of class years and majors with the registrar's, which shows whether the respondents resemble the enrolled population; re-run the question with the admissions office's exact wording and look at the size of the remaining gap; or draw a random sample of SUNet IDs and ask them directly, which removes the self-selection.*

What is something new you learned today?

(Your own answer.)