LESSON MAKER PRO

Survey Signal

Estimate a population, then test the estimate with simulations.

HIGH SCHOOL · MA.912.DP.1.4

MA.912.DP.1.4 "Estimate a population total, mean or percentage using data from a sample survey; develop a margin of error through the use of simulation."

NAME _____ DATE _____

SAMPLE TO POPULATION

Use a sample percentage to estimate a population percentage. A few simulated results show observed spread, not a calibrated survey margin of error. To develop a model-based bound, use many same-size simulations and state the intended coverage; Apply 3 uses at least 95% empirical coverage within its simulation model.

WORKED EXAMPLE

In a survey of 32 students, 20 choose option A. Four illustrative same-size simulation results are 56%, 59%, 65%, and 69%. Estimate the population percentage, then find the largest observed deviation and symmetric spread interval. This short list does not establish a calibrated margin of error.

1. 20/32 = 0.625 = 62.5%.
2. Compare each simulated percentage to 62.5%.
3. The largest observed distance is 6.5 percentage points; this depends on these four results.
4. The illustrative symmetric interval is 62.5% +/- 6.5 percentage points, or 56% to 69%; no confidence coverage is established.

Answer: Estimate 62.5%; largest observed deviation 6.5 percentage points; illustrative interval 56% to 69%.

PRACTICE 5 problems

1 A sample of 40 students includes 14 who ride a bus to school. Estimate the population percentage.

ANSWER _____

2 A sample of 50 students includes 18 who buy lunch at school. The school has 900 students. Estimate how many buy lunch.

ANSWER _____

3 A survey estimate is 48%. Simulated estimates are 43%, 46%, 51%, and 55%. Find the largest observed deviation and symmetric spread interval, not a calibrated margin of error.

ANSWER _____

_____

4 A sample of 30 students includes 21 who use a streaming service. The school has 600 students. Estimate how many use one.

ANSWER _____

5 A survey estimate is 72%. Simulated estimates are 68%, 75%, and 77%. Find the largest observed deviation and symmetric spread interval, not a calibrated margin of error.

ANSWER _____

_____

APPLY IT Show your work

1 An esports club surveys 80 students, and 48 say they would attend a tournament. The school has 1,200 students. Simulated survey percentages are 57%, 58%, 61%, and 63%. Estimate the number who would attend and give an illustrative range based on the largest observed deviation. This short simulation list does not establish confidence coverage.

WORK SPACE

ANSWER _____

2 Student council surveys 75 students, and 30 prefer more outdoor lunch seating. The school has 1,500 students. Simulated survey percentages are 35%, 38%, 42%, and 44%. Estimate the number who prefer outdoor seating and give an illustrative range based on the largest observed deviation. This short simulation list does not establish confidence coverage.

WORK SPACE

ANSWER _____

3 Develop an empirical simulation-based margin. A sample survey has 50 yes responses out of 100. For a classroom model, 1,000 independent simulated samples of size 100 were drawn with yes/no equally likely. The table counts estimates within each symmetric distance of the model value 50%. Choose the smallest listed bound covering at least 95% of these simulations. Show its coverage and give the symmetric interval around the survey estimate. Explain why this is a model-based bound, not a guarantee about the actual population.

SAME-SIZE SIMULATION COVERAGE (1,000 TRIALS)

Candidate bound (percentage points)	Trials within bound
5	753
10	966
15	998
20	1000

ANSWER _____

CHALLENGE One step up

Survey A has 200 students, with 110 answering yes. Its simulated percentages are 50%, 53%, 54%, 55%, and 57%. Survey B has 40 students, with 22 answering yes. Its simulated percentages are 45%, 49%, 55%, 60%, and 66%. Which listed simulation set has the smaller largest observed deviation? Do not claim a calibrated margin of error from these five results. Explain using the simulations.

WORK SPACE AND ANSWER

Survey Signal

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A sample of 40 students includes 14 who ride a bus to school. Estimate the population percentage.	**35%**
2	A sample of 50 students includes 18 who buy lunch at school. The school has 900 students. Estimate how many buy lunch.	**324 students**
3	A survey estimate is 48%. Simulated estimates are 43%, 46%, 51%, and 55%. Find the largest observed deviation and symmetric spread interval, not a calibrated margin of error.	**7 percentage points; 41% to 55%**
4	A sample of 30 students includes 21 who use a streaming service. The school has 600 students. Estimate how many use one.	**420 students**
5	A survey estimate is 72%. Simulated estimates are 68%, 75%, and 77%. Find the largest observed deviation and symmetric spread interval, not a calibrated margin of error.	**5 percentage points; 67% to 77%**

PART 2 · APPLY IT

1. **Estimate: 720 students. Largest observed deviation: 3 percentage points. Illustrative range: 684 to 756 students.** The sample estimate is 48/80 = 60%, so 60% of 1,200 is 720. The greatest simulated distance from 60% is 3%, giving 57% to 63% of the school.
2. **Estimate: 600 students. Largest observed deviation: 5 percentage points. Illustrative range: 525 to 675 students.** The sample estimate is 30/75 = 40%, so 40% of 1,500 is 600. The greatest simulated distance is 5%, giving 35% to 45% of the school.
3. **10 percentage points; 966/1000 = 96.6% empirical coverage; interval 40% to 60%.** Five points covers 75.3%, below 95%; ten covers 96.6%, so ten is the smallest listed qualifying bound. This margin describes the supplied fair-outcome model and finite simulation run; it does not guarantee actual population coverage or remove sampling bias.

CHALLENGE

Survey A. Both estimates are 55%, but Survey A has a largest observed deviation of 5 percentage points and Survey B has a largest observed deviation of 11 percentage points. Survey A's simulated estimates are less spread out. This comparison describes only the supplied results, not a calibrated confidence interval.

Accept equivalent estimates and symmetric observed-spread calculations for the short lists, stated in percentage points. Do not call their extrema calibrated margins of error. Apply 3 requires the smallest listed bound meeting the stated empirical coverage and an explicit simulation-model limitation.