

AP Statistics - Sampling Methods and Bias in Surveys - Answer Key

Common Core AP STAT 3.1, AP STAT 3.2, AP STAT 3.3, HSS-IC.B.3 · maths-pdf.fr/en/

Each solution names the method or bias, shows any random digit selection step by step, and gives a reason in context. Where a random selection is asked, the digits used are listed in the problem.

AP Statistics · Common Core State Standards: **AP STAT 3.1, AP STAT 3.2, AP STAT 3.3, HSS-IC.B.3**

Exercise 1 - Population, sample, statistic

Population: all 45,000 voters. Sample: the 200 voters surveyed.

Statistic: $\hat{p} = \frac{112}{200} = 0.56$.

Population: 45,000 voters; sample: 200 voters; statistic: 56%.

Exercise 2 - Parameter or statistic?

A parameter describes a whole population; a statistic describes a sample.

(a) parameter; (b) statistic; (c) parameter; (d) statistic.

Exercise 3 - Name the sampling method

(a) Every group of 90 students has an equal chance: SRS. (b) Convenience sample. (c) Whole groups are chosen: cluster sample. (d) A random sample from every team: stratified sample.

(a) SRS; (b) convenience; (c) cluster; (d) stratified.

Exercise 4 - SRS with random digits

Random digits
81 53 17 04 77 29 60 12 33 08 94 41 56 22 19

Random digits for the selection.

Read pairs: 81 skipped (out of range), 53 selected, 17 selected, 04 selected, 77 skipped (out of range), 29 selected, 60 selected.

Members 53, 17, 04, 29, 60.

Exercise 5 - Systematic sample



Systematic sample of 15 labels.

5, 13, 21, ... adding 8 each time: 5, 13, 21, 29, 37, 45, 53, 61, 69, 77, 85, 93, 101, 109, 117.

15 students.

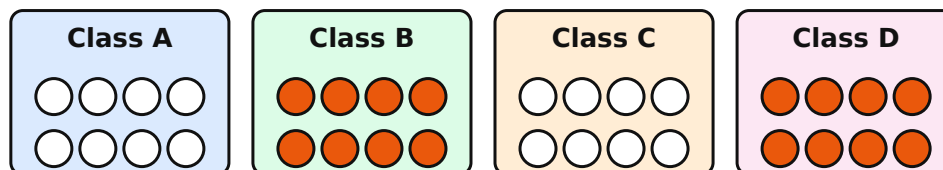
Exercise 6 - Stratified allocation

Sampling fraction: $\frac{60}{900} = \frac{1}{15}$.

Grade 9: $300/15 = 20.00$; Grade 10: $240/15 = 16.00$; Grade 11: $200/15 = 13.33$; Grade 12: $160/15 = 10.67$.

Take an SRS of 20 from Grade 9, 16 from Grade 10, about 13 from Grade 11 (13.33), and about 11 from Grade 12 (10.67), so that the total is 60.

Exercise 7 - Cluster or stratified?



Cluster sample: randomly select whole clusters and survey every member of those clusters.

Whole schools are chosen at random, and every teacher in those schools is surveyed.

Cluster sample: schools are the clusters.

Exercise 8 - Convenience sample

He chose students who were easy to reach.

Convenience sample; biased toward students who play sports and like them.

Exercise 9 - Voluntary response

Callers volunteered, and people with strong opinions are more likely to call.

No: voluntary response bias. The sample is not random and is not representative.

Exercise 10 - Undercoverage

Many households have no landline, and people who work during the day are not home.

Undercoverage (and possibly nonresponse): some groups have no chance of being selected.

Exercise 11 - Nonresponse

People who do not reply may differ from those who do.

Nonresponse bias; the 380 non-responders may have different opinions.

Exercise 12 - Response bias

Wording B includes loaded words ("raising your taxes", "unneeded").

Question B is biased and pushes people to say no.

Exercise 13 - Bigger sample

Sample size reduces random variation but cannot repair a biased selection method.

No. The random sample of 400 is more trustworthy because it avoids bias.

Exercise 14 - Describe an SRS procedure

Label students 001 to 150. Use a random number generator (or random digits in groups of three) to choose 12 different labels in the range 001 to 150, skipping repeats and numbers above 150.

The students with those 12 labels form the SRS.

Exercise 15 - Why stratify?

An SRS might include too few boarding students by chance.

Stratifying guarantees that both groups are represented in the right proportions and can improve precision.

Exercise 16 - Sampling variability

Each random sample contains different individuals.

Sampling variability: statistics vary from sample to sample; the parameter itself is fixed.

Exercise 17 - Choose the method

The trailheads are similar and costly to reach, so surveying complete groups at a few of them saves travel.

Cluster sample: randomly select 5 trailheads and survey all visitors there.

Exercise 18 - Which bias?

(a) People may answer untruthfully: response bias. (b) Readers choose to answer: voluntary response. (c) Many chosen households do not respond: nonresponse.

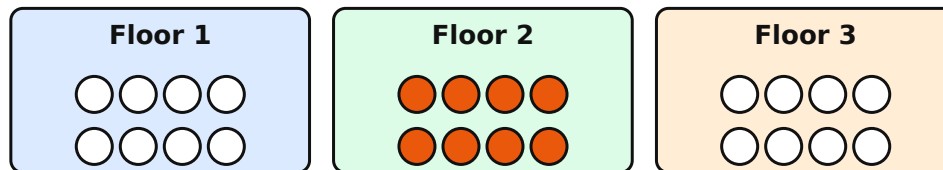
(a) response bias; (b) voluntary response; (c) nonresponse.

Exercise 19 - Multi-step design

Fraction: $\frac{50}{1000} = 0.05$. Freshmen: $0.05 \times 600 = 30$. Seniors: $0.05 \times 400 = 20$.

Take an SRS of 30 freshmen and an SRS of 20 seniors.

Exercise 20 - Pick the cluster



One cluster chosen.

The chosen floor has 8 residents, so 8 residents are surveyed.

8 residents. If the floors differ (for example in age or noise), one cluster may not represent the whole building.