Name _____

Period ____

Four Ways to Draw

Today you draw four samples of 10 from a school of 100, four ways, and find each one's bias. You answer in your Sheet and hand in its link. Nothing on paper.

What you submit in Canvas: your Sheet's link. Classwork 11, 10 points In Canvas: your Sheet's link.

- **4** H2 to H5 on your L25 tab, 1 point each. Each counts if its draw is frozen
- **4** Q1 and Q2, 2 points each
- **2** Q3, on your own, scored right or wrong

The school is made up: 100 students, each with a grade, a homeroom of 10 and hours of sleep. The population is all 100.

Your Sheet, in pairs

1. Go to sheets.new.
2. Click the file name at the top left. Rename it: **L25 school, your name**.
3. Right-click the **Sheet1** tab > **Rename** > L25.
4. Download **L25-school.csv** from today's Canvas module.
5. **File > Import > Upload**. Pick L25-school.csv.
6. **Import location: Insert new sheet(s)** > **Import data**.
7. Right-click the new tab > **Rename** > SCHOOL.
8. Click the **L25** tab.
9. In A1 to D1, type: id, grade, homeroom, sleep.
10. In F1, G1 and H1, type: Way, Mean, Bias.
11. In F2 to F6, type: Simple random, Systematic, Stratified, Cluster, True mean.

Tell your partner a guess before G6 shows: the mean sleep of all 100.

12. Click cell G6. Type: `=AVERAGE(SCHOOL!D2:D101)`

1. Simple random: shuffle the school, take the first 10

13. Click cell A2. Type: `=SORT(SCHOOL!A2:D101,RANDARRAY(100,1),TRUE)` Press **Return**.
14. Click the Name box. Type A2:D101. Press **Return**.
15. Press **Command-C**.
16. **Edit > Paste special > Values only**. The order stops changing.
17. Click cell G2. Type: `=AVERAGE(D2:D11)`

Rows 2 to 11 are the first 10 of a shuffle, so every set of 10 had the same chance: a **simple random sample**.

2. Systematic: a random start, then every 10th id

18. Click cell J1. Type: Start
19. Click cell K1. Type: `=RANDBETWEEN(1,10)` Press **Return**.
20. Click cell K1. Press **Command-C**.
21. **Edit > Paste special > Values only**.
22. Click cell J2. Type: `=FILTER(SCHOOL!A2:D101,MOD(SCHOOL!A2:A101-K1,10)=0)`
23. Click cell G3. Type: `=AVERAGE(M2:M11)`

`MOD(id − start, 10) = 0` keeps the start, then every 10th id after it.

3. Stratified: at random from each grade, in proportion

Grades 9 and 10 have 30 students each, grades 11 and 12 have 20. So 10 of 100 is 3, 3, 2 and 2.

24. Click cell O2. Type: `=ARRAY_CONSTRAIN(FILTER(A2:D101,B2:B101=9),3,4)`
25. Click cell O5. Type: `=ARRAY_CONSTRAIN(FILTER(A2:D101,B2:B101=10),3,4)`
26. Click cell O8. Type: `=ARRAY_CONSTRAIN(FILTER(A2:D101,B2:B101=11),2,4)`
27. Click cell O10. Type: `=ARRAY_CONSTRAIN(FILTER(A2:D101,B2:B101=12),2,4)`
28. Click cell G4. Type: `=AVERAGE(R2:R11)`

`FILTER` keeps one grade of your shuffled school, still shuffled. `ARRAY_CONSTRAIN` keeps its first 3 rows (or 2) and all 4 columns.

4. Cluster: one homeroom at random, everyone in it

29. Click cell T1. Type: Homeroom
30. Click cell U1. Type: `=RANDBETWEEN(1,10)` Press **Return**.
31. Click cell U1. Press **Command-C**.
32. **Edit > Paste special > Values only**.
33. Click cell T2. Type: `=FILTER(SCHOOL!A2:D101,SCHOOL!C2:C101=U1)`
34. Click cell G5. Type: `=AVERAGE(W2:W11)`

The bias of each way

35. In H2, H3, H4 and H5, type: `=G2-G6`, `=G3-G6`, `=G4-G6`, `=G5-G6`

Bias = sample mean − true mean (L24). **Hands up** when Mr. Case asks, way by way: is your bias above 0.3 or below −0.3?

36. Click cell F13. Type one sentence: which way came closest to the true mean, and which missed most? Use H2 to H5. This is **Q1**.

Your cluster: look at U2 to U11, the grades in your homeroom. Then look at G5 and G6.

37. Click cell F14. Type one sentence: why can one homeroom miss by so much in this school, and which way fixes that? This is **Q2**.

Your project file: SAMPLE, and one line on ABOUT

Not done by the bell? Finish SAMPLE before **Wednesday 16 December**, for L27. ABOUT is part of P2, due Friday 18 December.

1. Open your project file, the Sheet you made for P1.
2. Find your dataset in the table. SAMPLE says No? Skip steps 3 to 13.

MY DATASET	CLEAN ROWS	SAMPLE?	ABOUT A7
Colleges	1,972	No	Sampled: no. Every college that reported admissions to IPEDS for 2023.
Bikeshare trips	36,574	Yes	Sampled: no. Every trip that started at 99 stations in September 2025.
Weather	10,958	Yes	Sampled: no. Every day from 1995 to 2024, at one station.
Trail counters	1,011	No	Sampled: no. Every day of 2024, at 3 counters the county placed.

SAMPLE, inside out: `FILTER` keeps columns A and B of each row whose B is a number, so the empty rows below your data stay out. `COUNT` counts those rows; `RANDARRAY` gives each a random number; `SORT` puts them in that order, a shuffle. `ARRAY_CONSTRAIN` keeps the first 300 rows and both columns: a simple random sample of 300.

3. Click the **+** at the bottom left.
4. Right-click the new tab > **Rename** > SAMPLE.
5. In A1 and B1, type: group, number.
6. Click cell A2. Type:
   `=ARRAY_CONSTRAIN(SORT(FILTER(CLEAN!A2:B,ISNUMBER(CLEAN!B2:B)),RANDARRAY(COUNT(CLEAN!B2:B),1),TRUE),300,2)`
7. Click the Name box. Type A2:B301. Press **Return**.
8. Press **Command-C**.
9. **Edit > Paste special > Values only**. The 300 rows stop changing.
10. In D1, D2 and D3, type: Mean of SAMPLE, Mean of CLEAN, Bias.
11. Click cell E1. Type: `=AVERAGE(B2:B301)`
12. Click cell E2. Type: `=AVERAGE(CLEAN!B:B)`
13. Click cell E3. Type: `=E1-E2`
14. Click the **ABOUT** tab.
15. Click cell A7. Type your dataset's line from the table.

No file here is a random sample: each is every row of a place and time someone chose. A7 says so, for P4's rubric.

On your own. No partner. Scored right or wrong.

A school has 500 students: 200 in grade 9, 150 in grade 10, 100 in grade 11 and 50 in grade 12. A stratified sample of 40 takes each grade in proportion.

Click the **L25** tab. Click cell F15. Type how many come from grade 11, as a formula. This is **Q3**.

Submit it

1. In your L25 school Sheet, click **Share**, top right.
2. Under **General access**, pick **Arlington Public Schools**.
3. Click **Copy link**. Click **Done**.
4. In Canvas, open **Classwork 11: L25 four ways**.
5. **Start Assignment** > **Website URL**. Paste your link. **Submit Assignment**.