

Sampling inference, expected value and counting

Original skill preparation; versioned source scope

Method and conditions

Choose 2 of 4: six unordered pairs; AB and BA count once

AB	AC	AD
BC	BD	CD

- A margin of error is added and subtracted in percentage points.
- Percentages; populations; random selection versus assignment.

Worked method 1

Read and reason

A margin of error is added and subtracted in percentage points. Estimate 63% with margin 4 points gives 59%–67%. It is an interval from a procedure, not a guarantee that each person's response is near 63%. Random sampling supports population inference; random assignment addresses treatment comparisons.

Original context 1

Read and reason

Task context

Read and reason

Each task below states its own complete data. Values may differ from the worked example.

Attempt 1.1

Read and reason

Six students choose a chairperson and a different secretary. How many assignments? How many unranked two-person committees? Explain the difference.

Reasoning 1.1

Read and reason

Ordered roles give $6(5) = 30$. Unranked pairs count each pair twice in that product, so there are $6(5)/2 = 15$. Swapping people changes roles but not an unranked committee.

Attempt 2.1

Read and reason

A game pays 12 tokens with probability 0.1, 3 with probability 0.4, and zero otherwise. Entry costs 2 tokens. Find expected payout and expected net gain. Does a player receive that amount every time?

Reasoning 2.1

Read and reason

Remaining probability is 0.5. $E(P) = 12(0.1) + 3(0.4) + 0(0.5) = 2.4$ tokens. Expected net is $E(G) = E(P) - 2 = 0.4$ token per play. Actual net outcomes are 10,1,-2; none equals 0.4, which is a long-run mean under the model.

Attempt 3.1

Read and reason

Two balls are drawn without replacement from a bag with 3 red and 2 blue balls. Find the probability both are red and of exactly one red.

Reasoning 3.1

Read and reason

$P(RR) = (3/5)(2/4) = 3/10$. Exactly one red can occur as RB or BR:

$P = (3/5)(2/4) + (2/5)(3/4) = 3/5$. The second denominator is 4; the draws are dependent.

Attempt 4.1

Read and reason

A random sample of 500 registered library members reports 62% support for a change, with stated margin 4 percentage points. State the interval and population. Does it establish support among every town resident?

Reasoning 4.1

Read and reason

Interval is $62\% - 4\% = 58\%$ to $62\% + 4\% = 66\%$, where the subtraction denotes points. The population is registered members in the sampling frame. Nonmembers were not sampled, so the estimate does not establish all residents' support.

Attempt 5.1

Read and reason

Forty volunteers are randomly assigned to old or new instructions, with the same task and conditions. The new group finishes faster. What causal and population claims are reasonable?

Reasoning 5.1

Read and reason

Random assignment supports a causal comparison of the instruction versions for these participants under the tested conditions, subject to variation. Volunteer selection limits population generalisation. It does not establish that every future user will finish faster.

Attempt 6.1

Read and reason

A poll of 10000 website volunteers has a narrow reported margin. Explain why size alone cannot repair selection bias, and propose a better recruitment method.

Reasoning 6.1

Read and reason

People choosing to respond can differ systematically from those who do not. A margin for sampling variability does not remove that bias. Select randomly from the defined target population and follow up nonresponse; still report limitations.

Transfer and limits

Read and reason

Percentages; populations; random selection versus assignment.

Check yourself

Read and reason

Close the worked reasoning. Explain why the method fits the final transfer task, reconstruct its conclusion, and state a condition that would change your answer. Then check the full reasoning in the reference.