

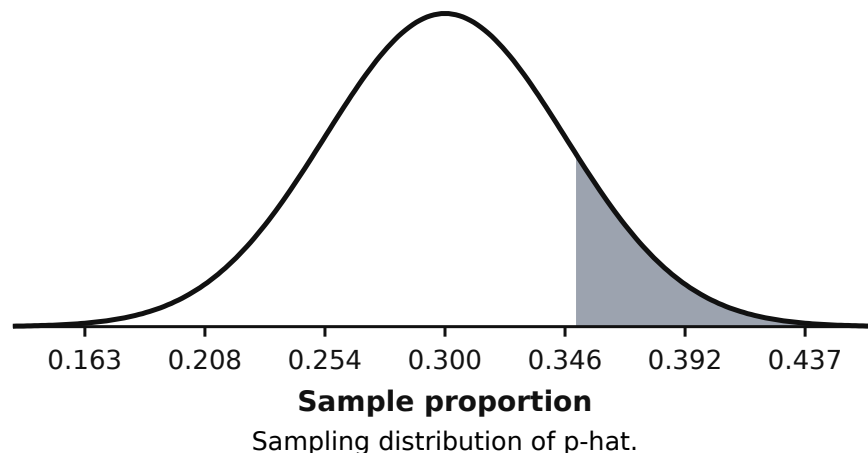
AP Statistics - Sampling Distributions and the Central Limit Theorem - Test Answer Key

Common Core AP STAT 5.1, AP STAT 5.2, AP STAT 5.3, AP STAT 5.4, AP STAT 5.5, AP STAT 5.6, AP STAT 5.7, HSS-IC.A.1, HSS-IC.A.2 · maths-pdf.fr/en/

Each solution includes a scoring guide. Give credit for correct parameters, a sketch or setup, a correct z-score, and a conclusion in context.

AP Statistics · Common Core State Standards: **AP STAT 5.1, AP STAT 5.2, AP STAT 5.3, AP STAT 5.4, AP STAT 5.5, AP STAT 5.6, AP STAT 5.7, HSS-IC.A.1, HSS-IC.A.2**

Question 1 - Proportion probability [4 pts]



(a) Mean 0.30; $sd \sqrt{0.3(0.7)/100} = 0.0458$. (b) $np = 30$ and $n(1-p) = 70$, both at least 10 (and the sample is under 10% of the population). (c) $z = 1.09$, $P(Z > 1.09) = 0.1379$.

0.30 and 0.0458; conditions met; 0.1379.

Scoring: 1 point for each of the mean and sd, 1 point for conditions, 1 point for the probability.

Question 2 - Sample mean [3 pts]

(a) $\mu_{\bar{x}} = 4.2$, $\sigma_{\bar{x}} = \frac{1.5}{6} = 0.25$; $n = 36$ is at least 30, so by the CLT the shape is approximately normal.

(b) $z = \frac{4.6 - 4.2}{0.25} = 1.6$, $P(Z > 1.6) = 0.0548$.

Approximately normal, mean 4.2, sd 0.25; 0.0548.

Scoring: 1 point for the mean and sd, 1 point for CLT and shape, 1 point for the probability.

Question 3 - Effect of n [2 pts]

$$\sqrt{0.25/100} = 0.05 \text{ and } \sqrt{0.25/400} = 0.025.$$

0.05 and 0.025: the spread is cut in half when n is multiplied by 4.

Scoring: 1 point for each standard deviation (with the halving statement required for full credit on the second).

Question 4 - Bias and variability [2 pts]

The first is centered at the parameter but spread widely; the second is narrow but centered at the wrong value.

Unbiased is usually preferred because its center is correct, and its variability can be reduced by a larger sample, but bias cannot.

Scoring: 1 point for each correct description and reason (2 points total).

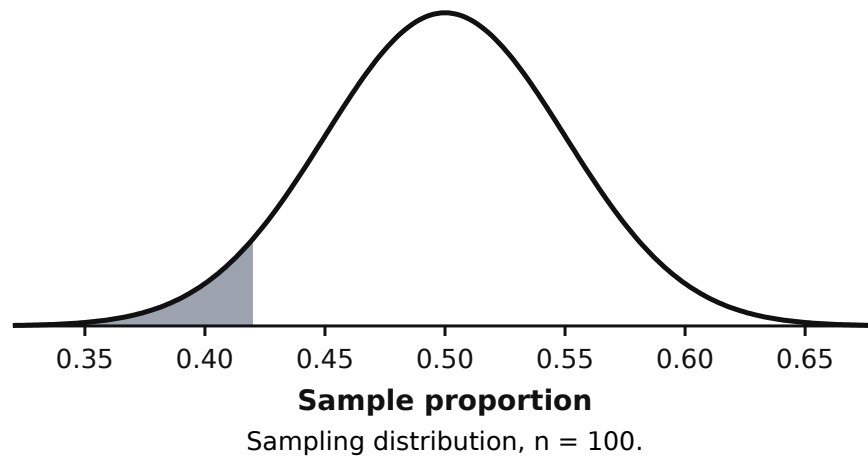
Question 5 - Difference of proportions [3 pts]

$$\text{Mean: } 0.5 - 0.4 = 0.1. \text{ SD: } \sqrt{\frac{0.5(0.5)}{80} + \frac{0.4(0.6)}{100}} = \sqrt{0.003125 + 0.0024} = 0.0743.$$

Mean 0.1; standard deviation 0.0743.

Scoring: 1 point for the mean, 1 point for variances, 1 point for the sd.

Question 6 - Poll probability [2 pts]



$$\sigma = \sqrt{0.5(0.5)/100} = 0.05. \quad z = \frac{0.42 - 0.5}{0.05} = -1.60. \quad P(Z < -1.60) = 0.0548.$$

0.0548.

Scoring: 1 point for the sd and z-score, 1 point for the probability.

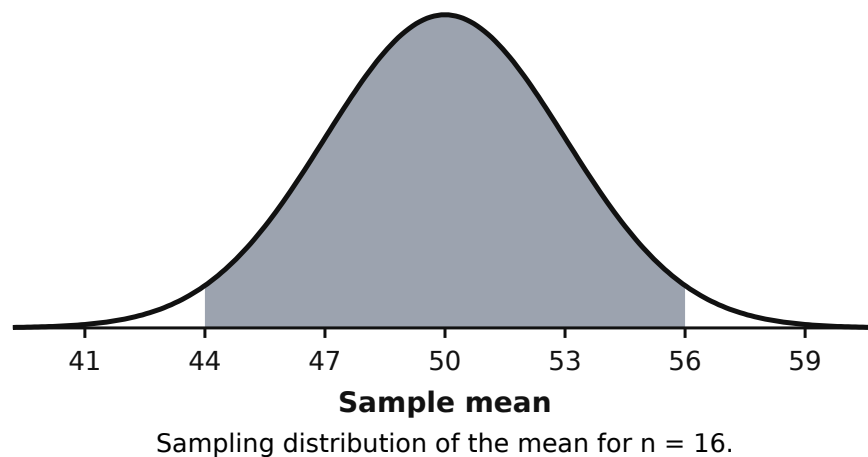
Question 7 - Conditions [2 pts]

$$np = 30(0.05) = 1.5, \text{ less than } 10.$$

Not approximately normal.

Scoring: 1 point for $np = 1.5$, 1 point for the conclusion.

Question 8 - Within two standard errors [2 pts]



$$\sigma_{\bar{x}} = \frac{12}{4} = 3. \quad 50 \pm 2(3) = (44, 56).$$

About 44 to 56.

Scoring: 1 point for the sd, 1 point for the interval.

Total
20 points