

AP Statistics - Sampling Distributions and the Central Limit Theorem - Worksheet

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/

Name: _____ Class: _____ Date: ____/____/____

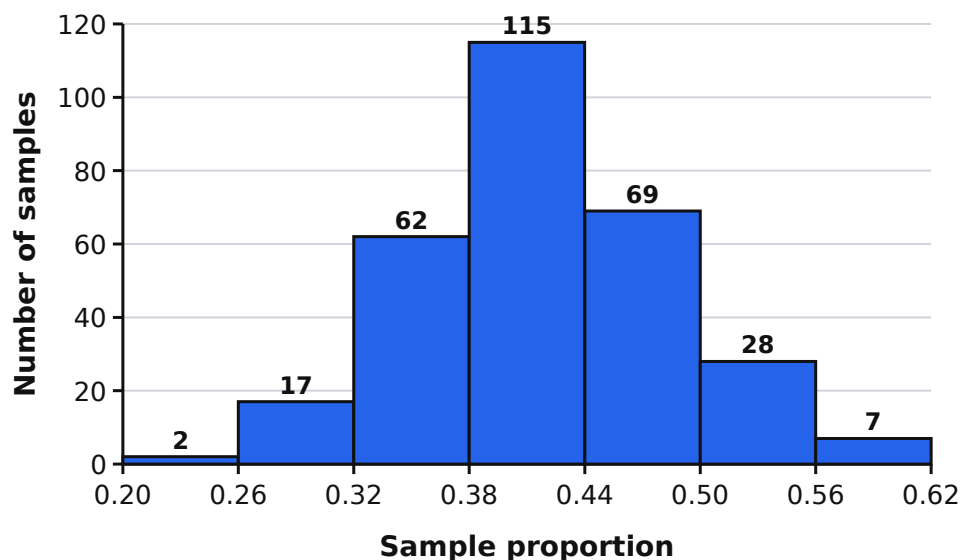
These 20 problems practice AP Statistics topics 5.1 to 5.7. You will find the mean and standard deviation of sampling distributions, check normality conditions, apply the central limit theorem, and compute probabilities for sample proportions, sample means, and differences.

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**

Exercise 1 - Parameter or statistic

Of all 12,000 registered voters in a district, 56% favor a measure. In a random sample of 400 voters, 53% favor it. Identify the parameter and the statistic.

Exercise 2 - Sampling variability



300 simulated sample proportions: centered at 0.40, approximately normal.

The histogram shows 300 sample proportions from samples of size 50 with $p = 0.40$. Describe the shape, center, and spread. What does it say about a single sample?

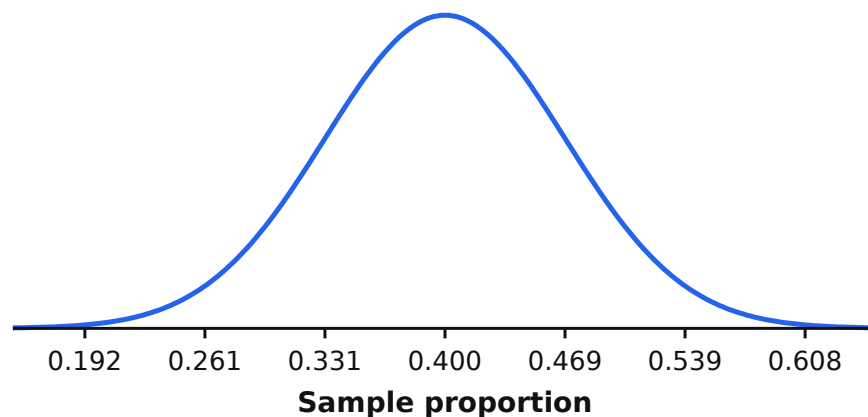
Exercise 3 - Mean and SD of p-hat

In a large city, 30% of adults have a library card. For random samples of 150 adults, find the mean and standard deviation of the sample proportion.

Exercise 4 - Check conditions

A random sample of 60 students is taken from a school of 900 students where 8% are left-handed. Can we use a normal model for the sample proportion?

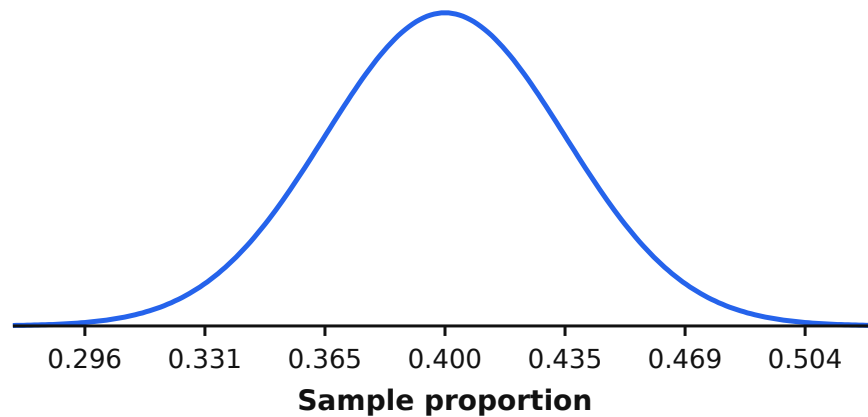
Exercise 5 - Probability for p-hat



Sampling distribution of $\hat{p}$ for $n = 50$: mean 0.40, standard deviation 0.069.

For random samples of 50 from a population with $p = 0.40$, find $P(\hat{p} > 0.50)$.

Exercise 6 - Effect of sample size



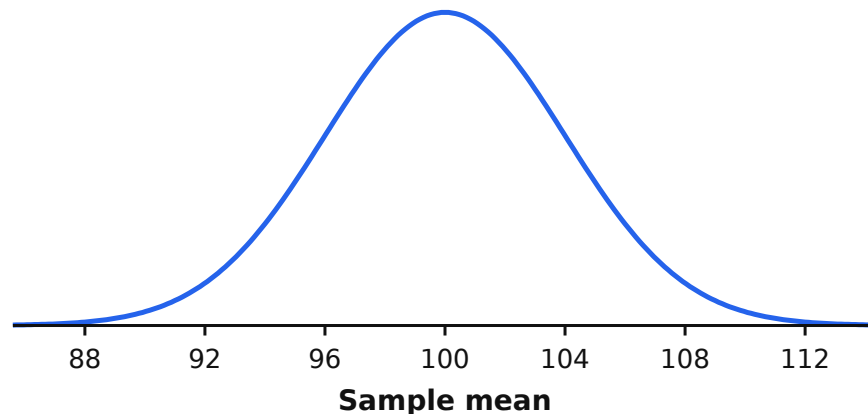
For $n = 200$ the standard deviation is 0.035: quadrupling n halves the spread.

Compare the standard deviation of $\hat{p}$ for $n = 50$ and $n = 200$ when $p = 0.40$. How is n changed?

Exercise 7 - Unbiased estimator

A statistic's sampling distribution (from many samples) is centered at 12, but the parameter is 10. Is the statistic unbiased? Would a larger sample fix this?

Exercise 8 - Mean and SD of $\bar{x}$



Sampling distribution of $\bar{x}$ for $n = 25$: mean 100, standard deviation 4.

A population of rental prices has mean \$1,200 and standard deviation \$300. Find the mean and standard deviation of the sample mean for samples of size 36.

Exercise 9 - Probability for $\bar{x}$

Heights of adult men are normal with mean 70 in and sd 3 in. Find the probability that the mean height of a random sample of 9 men exceeds 71 inches.

Exercise 10 - Individual versus mean

Using the heights above, find the probability that one randomly chosen man is taller than 71 inches, and compare it with the previous problem.

Exercise 11 - Central limit theorem

The time between customer arrivals is strongly right-skewed with mean 5 minutes and sd 5 minutes. For a random sample of 100 arrivals, describe the sampling distribution of the mean.

Exercise 12 - Is n large enough?

A population is strongly skewed. Is a sample of $n = 8$ enough to use a normal model for the sample mean? What about $n = 50$?

Exercise 13 - Difference of proportions

In city A, 40% of households recycle; in city B, 30% do. Independent random samples of 100 households from A and 120 from B are taken. Find the mean and standard deviation of $\hat{p}_A$ minus $\hat{p}_B$.

Exercise 14 - Probability of a difference

Using the recycling samples above (mean 0.10, sd 0.0644, approximately normal), find $P(\hat{p}_A - \hat{p}_B < 0)$.

Exercise 15 - Difference of means

Boys' reaction times have mean 250 ms and sd 30; girls' have mean 240 ms and sd 25. Independent samples of 40 boys and 50 girls are taken. Find the mean and standard deviation

of $\bar{x}$ boys minus $\bar{x}$ girls.

Exercise 16 - Sample size needed

For $p = 0.5$, how large must n be so that the standard deviation of $\hat{p}$ is at most 0.025?

Exercise 17 - Interpret the standard deviation

For samples of 400 voters, the standard deviation of $\hat{p}$ is 0.025. Interpret it in context.

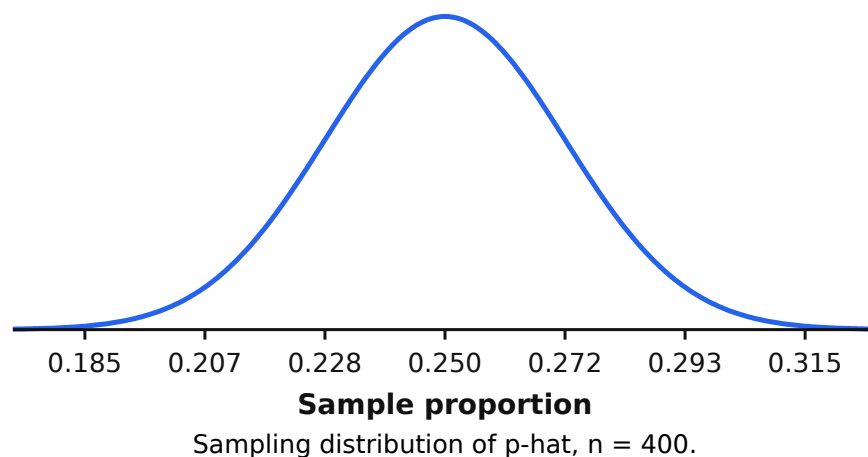
Exercise 18 - Within two standard deviations

A population has $p = 0.6$. For $n = 100$, between which two values will about 95% of sample proportions fall?

Exercise 19 - Multi-step

Cereal boxes have mean weight 16.1 oz and sd 0.4 oz (approximately normal). A case contains 16 random boxes. Find the probability the mean weight of the case is below 16 oz.

Exercise 20 - Poll accuracy



A school wants to know the proportion of students who bring lunch. Suppose the true proportion is 0.25. A random sample of 400 students is taken. Find the probability that the

sample proportion is below 0.22.