

AP Statistics – Chapter 9 Notes: Sampling Distributions

9.1 – Sampling Distributions

Parameter – a number that describes a population (usually unknown)

Statistics – a number that describes a sample (used to estimate a parameter)

Symbols used	Sample Statistic	Population Parameter
Proportions	\hat{p}	p
Means	\bar{x}	μ

Sampling Distribution – the distribution of all values taken by a statistic in all possible samples of the same size from the same population

A statistic is called an **unbiased estimator** of a parameter if the mean of its sampling distribution is equal to the parameter being estimated

Important Concepts for unbiased estimators

- The mean of a sampling distribution will always equal the mean of the population for any sample size
- The spread of a sampling distribution is affected by the sample size, *not the population size*. Specifically, larger sample sizes result in smaller spread.

9.2 – Sample Proportions

Choose an SRS of size n from a large population with population proportion p having some characteristic of interest.

Let \hat{p} be the proportion of the sample having that characteristic. Then the mean and standard deviation of the sampling distribution of \hat{p} are

$$\text{Mean: } \mu_{\hat{p}} = p$$

$$\text{Std. Dev.: } \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

CONDITIONS FOR NORMALITY

Rule Of Thumb 1

Use the formula for the standard deviation of \hat{p} only when the size of the population is at least 10 times as large as the sample size.

Rule Of Thumb 2

We will use the normal approximation to the sampling distribution of \hat{p} for values of n and p that satisfy $np \geq 10$ and $n(1-p) \geq 10$.

9.3 – Sample Means

Suppose that \bar{x} is the mean of a sample from a large population with mean μ and standard deviation σ . Then the mean and standard deviation of the sampling distribution of \bar{x} are

$$\text{Mean: } \mu_{\bar{x}} = \mu$$

$$\text{Std. Dev.: } \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

CONDITIONS FOR NORMALITY

If an SRS is drawn from a population that has the normal distribution with mean μ and standard deviation σ , then the sample mean \bar{x} will have the normal distribution $N(\mu, \sigma/\sqrt{n})$ for any sample size.

Central Limit Theorem

If an SRS is drawn from any population with mean μ and standard deviation σ , when n is large ($n \geq 30$), the sampling distribution of the sample mean \bar{x} will have the normal distribution $N(\mu, \sigma/\sqrt{n})$.

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