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 <u>always</u> 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

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

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

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 $np \geq 10$ <u>and</u> $n(1-p) \geq 10$.

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

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

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

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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