7.3 Sample Means

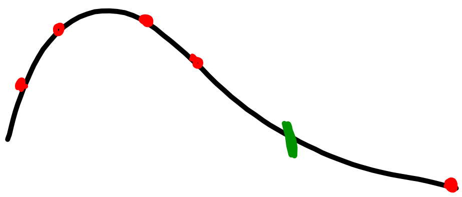
when using qualitative data typically we use $\hat{p}$ as our sample statistic. When using quantative data we use $\bar{x}$, the sample mean.

Mean + Standard deviation of the sampling distribution of $\bar{x}$

Suppose $\bar{x}$ is the mean of a SRS of size n drawn from a large population. Assume the sample has mean μ and standard deviation σ.

The mean of the sampling distribution of $\bar{x}$ is $\mu_{\bar{x}} = \mu$

The standard deviation of the sampling distribution of $\bar{x}$ is: $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$, 10% condition must be met



Sampling from a Normal Distribution

Suppose that a population has the $N(\mu, \sigma)$ distribution. Then the sampling distribution has the normal distribution with mean μ and standard deviation of $\sigma/\sqrt{n}$ (10% condition).

Ex: At the nutty Peanut company, shelled peanuts are placed in jars by a machine. The distribution of weights approximately follow the $N(16.1, .15)$ distribution.

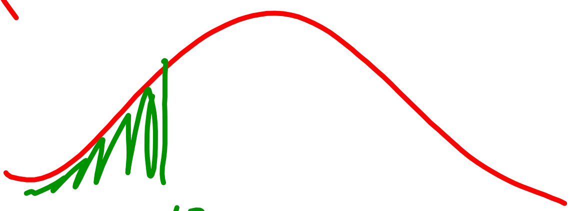
a) What is more likely: randomly drawing 1 jar and its weight is less than 16 oz. or randomly selecting 10 jars and finding average weight is less then 16 oz?

b) Find the probability that a randomly selected jar has less than 16 oz.

$P(X<16) = P\left(z < \frac{X-\mu}{\sigma}\right)$

normalcdf(lowerbound: -9999, upperbound: 16, μ=16.1, σ=.15)

= .2525



Ex: Find the probability 10 randomly selected jars contain less than 16 oz. on average.

$P(\mu_{\bar{x}} < 16)$ $\quad z = \frac{\mu_{\bar{x}} - \mu}{\sigma/\sqrt{n}} = \frac{16-16.1}{.15/\sqrt{10}} = -.2108$

$P(z < -.2108) = .4168$

Central Limit Theorem (CLT)

Draw an SRS of size n from any population mean μ and finite standard deviation σ. The Central Limit Theorem says that when n is large, the sampling distribution of the sample mean, $\bar{x}$, is Normal.

Normal/Large sample conditions for $\bar{x}$.

- If the population is Normal, so is the sampling distribution of $\bar{x}$ regardless of sample size n.
- If the population is NOT Normal, CLT tells us the sampling distribution of $\bar{x}$ will be approximately Normal if $n \geq 30$.

Suppose the number of texts sent during a typical day by students at a large school follows a right skewed distribution with $\mu = 45$ and $\sigma = 35$. How likely is it that an SRS of 50 students will have sent more than 2500 texts in the last day?

Large school, and $n \geq 30$, since its an SRS 50.

$$P\left(\bar{x} > \frac{2500}{50}\right) = P(\bar{x} > 50)$$

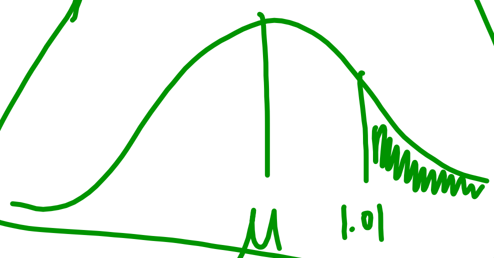
$$z = \frac{50 - 45}{35/\sqrt{50}}$$

$z = 1.01$

$P(z > 1.01)$

$1 - P(z \leq 1.01)$

.16



· 16% they will have sent more than 2500 texts