

March 7, 2011
It is E370 Time!!!

□ Announcements

- ✓ Stephen Stigler - Ernest DeWitt Burton Distinguished Service Professor, University of Chicago Department of Statistics

"Darwin, Galton, and Pearson: The Rule of Three and the Beginning of Multivariate Statistics"

✧ Thursday, March 10th at 4:00 PM

✧ Swain Hall East, room 140

- ✓ Refreshments will be available in Rawles Hall, room 107 prior to the lecture.

- ✓ Team Project - Part Two - "Variable Descriptions and Relationships" is due the week you return from Spring Break.

- A question to get you thinking: The time, T , it takes to make and deliver a Papa John's pizza is a normally distributed random variable with a mean of 32 minutes and a standard deviation of 3 minutes. Suppose three pizza delivery orders were randomly selected.

- ✓ Define $Q_i = T_i + T_j + T_k$ where each time, T , is from the same distribution described above.

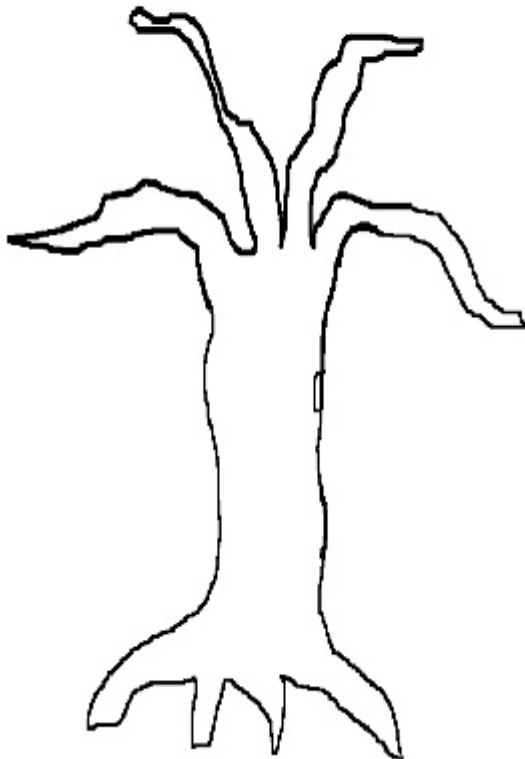
✧ What is $E(Q_i)$?

✧ What is $V(Q_i)$?

✧ What is the standard deviation of Q_i ?

- What will we do today?
 - ✓ Practice a little linear combination.
 - ✓ Step back and get some perspective.
 - ✓ Take the next logical step and think about statistics as random variables.
 - ✓ Look at some sampling distributions.
 - ✓ Describe what we see happening.
 - ✓ Practice with the sampling distribution of the sample mean.
 - ✓ Derive the sampling distribution of the sample proportion.
 - ✓ Try and figure out how this is going to help us.

As statisticians and business persons, what do we want to know?



✓ Define $\bar{Q}_a = \frac{1}{3} T_i + \frac{1}{3} T_j + \frac{1}{3} T_k$

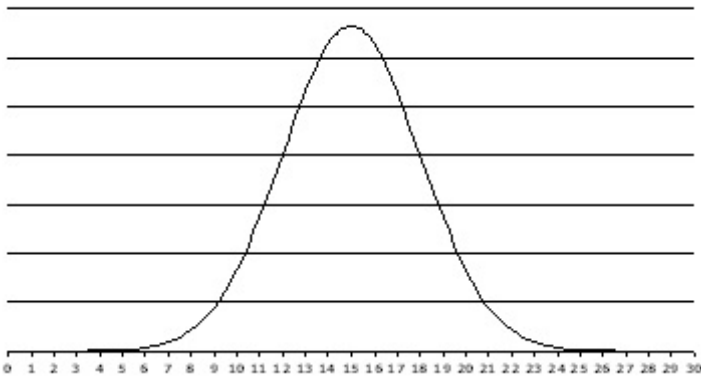
time, T , is from the same distribution described on the previous page.

✧ What is $E(\bar{Q}_a)$?

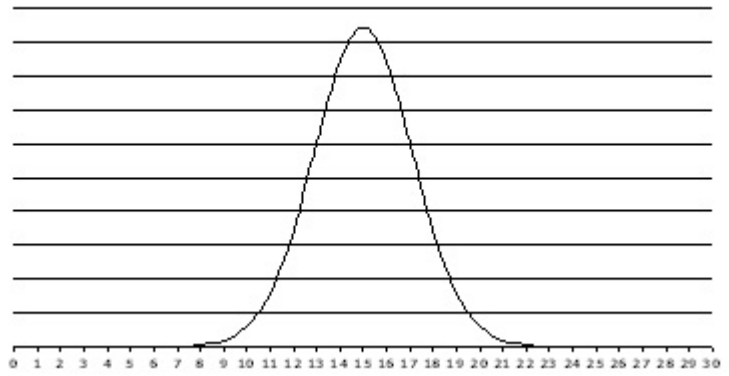
✧ What is $V(\bar{Q}_a)$?

✧ What is the standard deviation of \bar{Q}_a ?

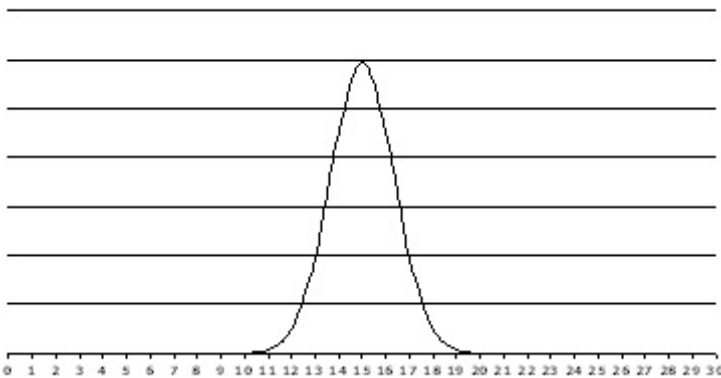
Normal Population



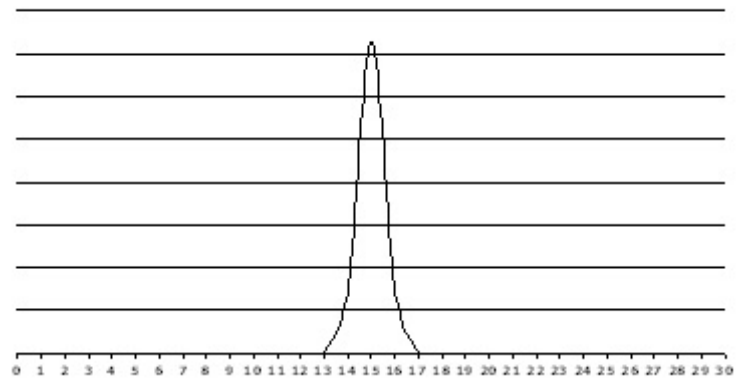
Means, n=2



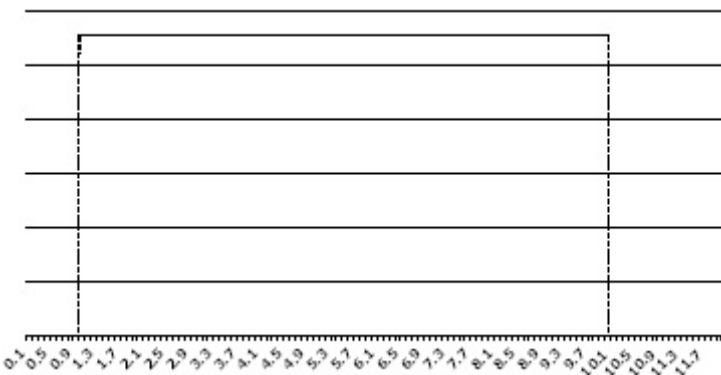
Means, n=5



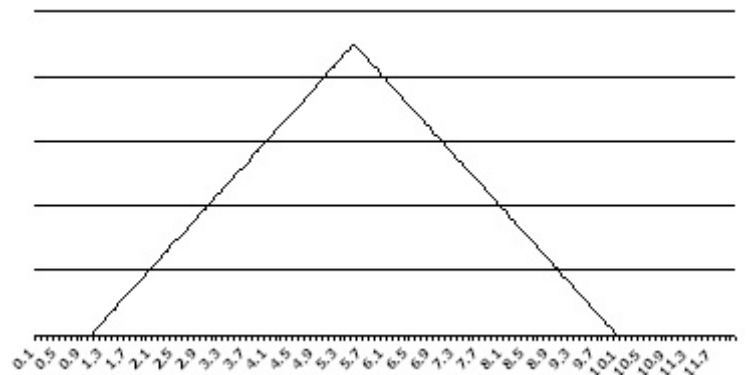
Means, n=30



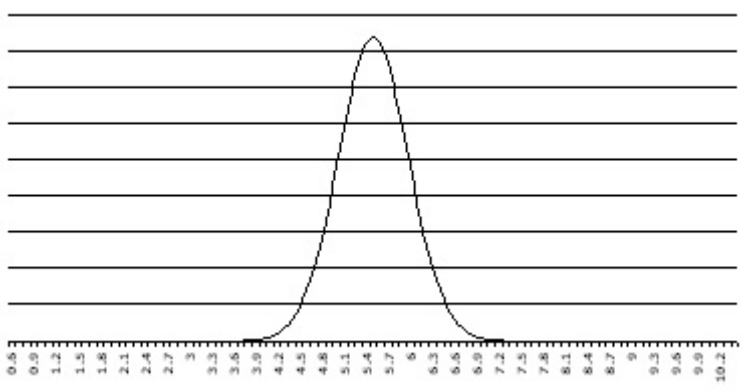
Uniform Population



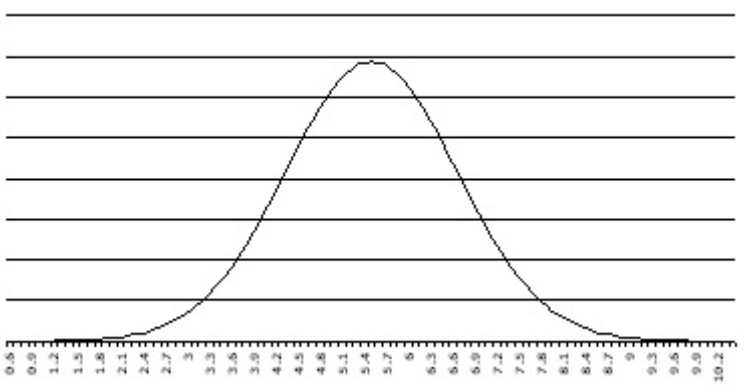
Means, n=2



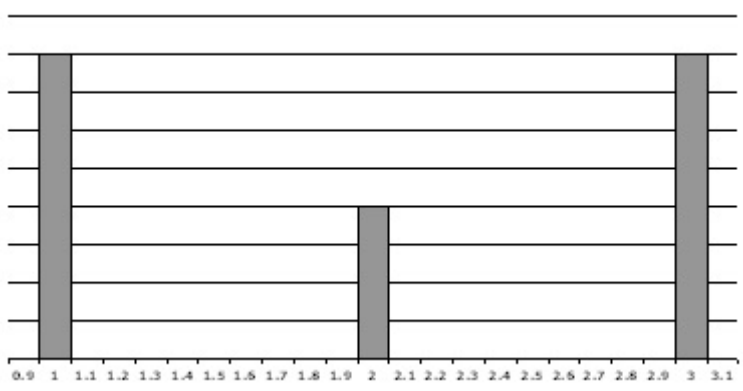
Means, n=30



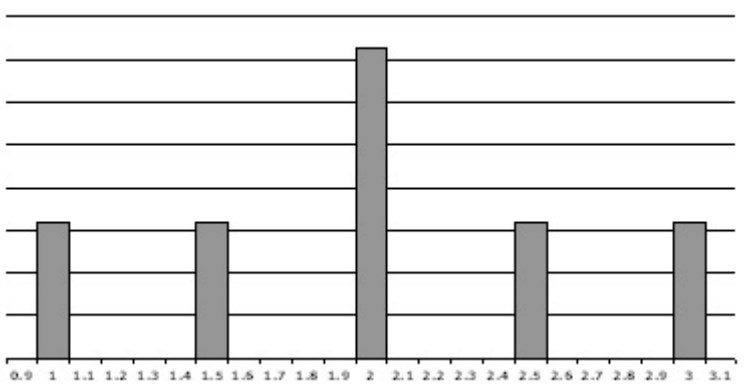
Means, n=5



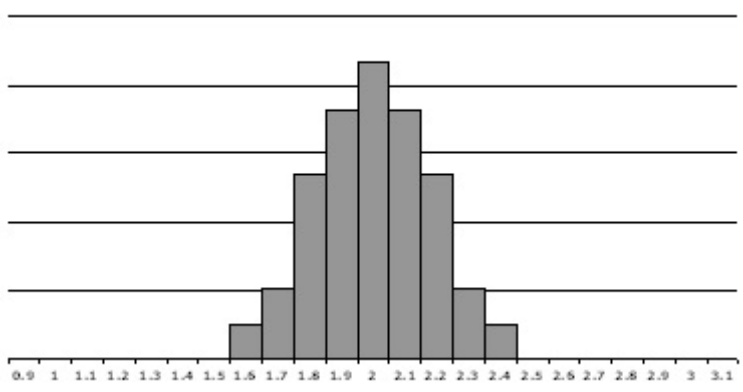
Bimodal Population



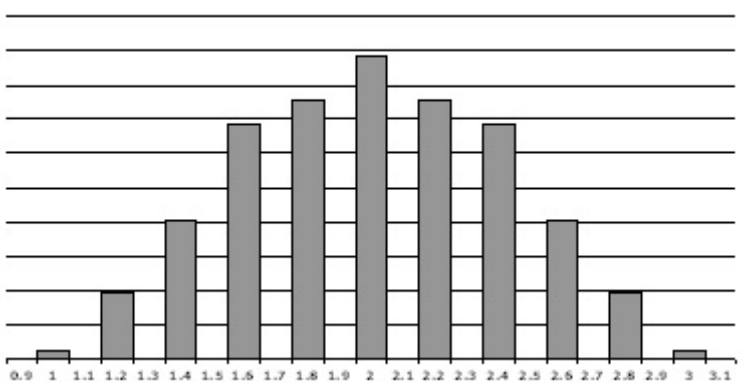
Means, n=2



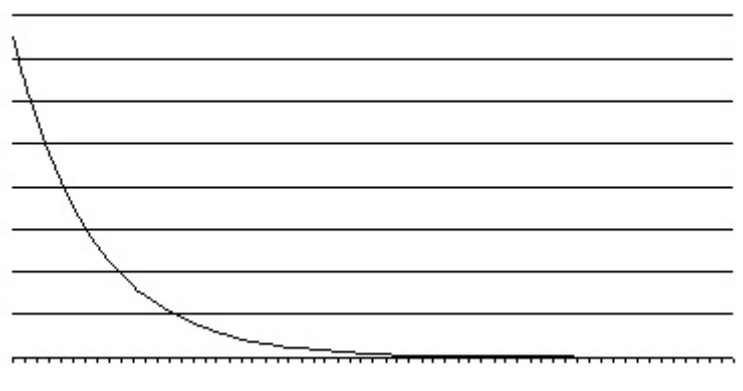
Means, n=30



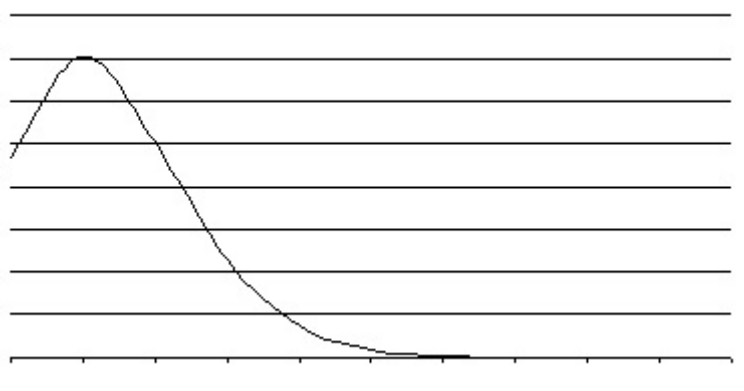
Means, n=5



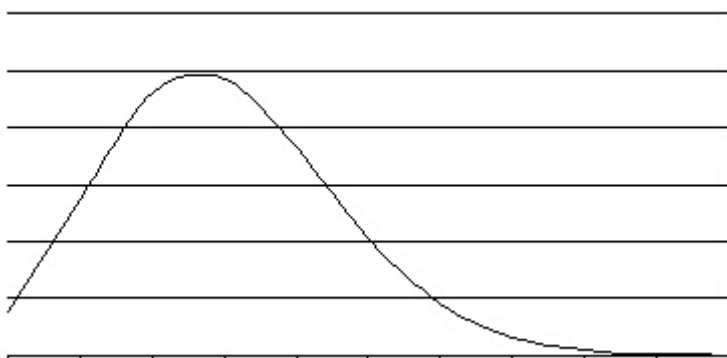
Exponential Population



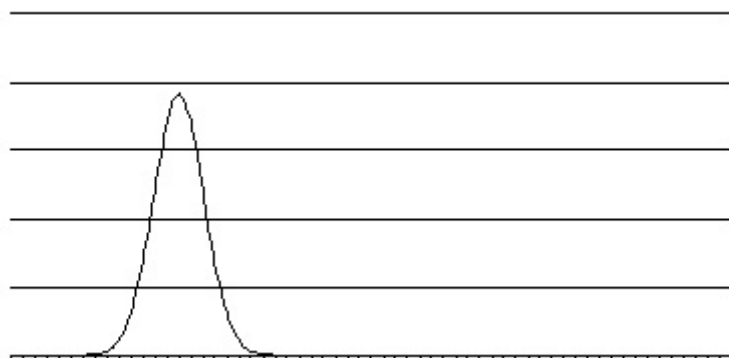
Means, n=2



Means, n=5



Means, n=30



- What are sampling distributions?
- What are the general parameters of sampling distributions?
- What do we know about the sampling distribution of the sample mean?

The sample mean

- ✓ is a random variable, thus it has a distribution.
- ✓ Each observation in the distribution is a mean from a sample of the same SIZE but with different values.
- ✓ The mean of the distribution of sample means is the population mean, μ .
- ✓ Its spread is the population standard deviation divided by the square root of the sample size.

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

- What about the shape of the distribution?
 - ✓ as n gets bigger, the shape of the distribution becomes bell-shaped, or Normal.
- In your teams: The number of pizzas consumed per month by university students is normally distributed and has a mean of 10 and a standard deviation of 3. What is the likelihood that a student will consume more than 12 pizzas per month? Respond with an Excel Command.
- A random sample of 25 students consumed 300 pizzas, that is, had a sample mean pizza consumption of 12 pizzas. What is the likelihood that samples of 25 students would consume more than 12 pizzas on average? Respond with an Excel Command.