STAT 113: NORMAL DISTRIBUTIONS

We often need to calculate areas under the tails of a Normal curve (e.g., to compute P-values), as well as to find particular quantiles of the Normal (e.g., to find the endpoints for a confidence interval). You can use StatKey to do this by selecting "Theoretical Distributions: Normal" and then "Edit Parameters" to change the mean and standard deviation. After that the interface is like what we have used for bootstrap and randomization distributions.

Or you can use R. The main R functions to do this are `xpnorm()` and `xqnorm()`.

Both use the following pattern (elements in caps, other than `TRUE` and `FALSE`, should be replaced by values).

```
## returns area to the left of CUTOFF in a N(MEAN,SD) distribution
xpnorm(CUTOFF, mean = MEAN, sd = SD, lower.tail = TRUE)
## returns area to the right of CUTOFF
xpnorm(CUTOFF, mean = MEAN, sd = SD, lower.tail = FALSE)
## returns the Pth quantile of a N(MEAN, SD) distribution
## (i.e., the value with proportion P below it)
xqnorm(PROPORTION, mean = MEAN, sd = SD, lower.tail = TRUE)
## returns the (1 - P)th quantile of a N(MEAN, SD) distribution
## (i.e., the value with proportion P above it)
xqnorm(PROPORTION, mean = MEAN, sd = SD, lower.tail = FALSE)
```

(1) Find the specified areas for a normal density.

(a) The area above 62 in a N(50,10) density.

(b) The area below 8 in a N(10,2) density.

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(2) Find the endpoint, x on the given normal density curve with the given property.

(a) The area to the right of x on a N(10,4) density curve is about 0.05.

(b) The area to the left of x on a N(100,25) density curve is about 0.35.

(3) Suppose weights of newborn babies in one community are normally distributed with a mean of 7.5 pounds and a standard deviation of 1.2 pounds.

(a) Use the 95% rule to sketch a graph of this normal density curve. Include a scale with at least three values on the horizontal axis.

(b) What percent of newborns weigh less than 5 pounds?

(c) What percent of newborns weight more than 11 pounds?

(d) If a newborn baby is at the 15th percentile for weight, what is the baby's weight?

(4) (a) Create a bootstrap distribution of 1000 sample means using the data on prices (in \$1,000's) of used Mustang cars in `MustangPrice` (this is in `Lock5Data` if you want to use R, or you can use StatKey: CI for a Mean)

(b) Find a 94% confidence interval using the appropriate quantiles of the bootstrap distribution.

(c) Consider a normal distribution where the mean is the 15.98 (the mean of the Mustang sample) and standard deviation equals the standard deviation of the bootstrap sample means. Find the quantiles of this Normal distribution that correspond to those you used for the bootstrap distribution.

(d) Compare the answer from the normal distribution to what you found from the bootstrap distribution. Are the results similar?

(5) In a sample of 120 soccer matches played in the Football Association (FA) premier league in Great Britain, the home team won 70 times. Create a randomization distribution of 1000 sample proportions to test whether is evidence for a home field advantage in this league. (You can use the `do() * rflip()` construction in R, or use StatKey)

(a) Find a one and two-tailed P-value using the randomization distribution.

(b) Consider using a normal distribution to model the sampling distribution of proportions under H_0 instead of the randomization distribution. What should the mean and standard deviation be? Calculate a P-value using this method.

(c) Compare the answer from the normal distribution to what you found from the randomization distribution. Are the results similar?