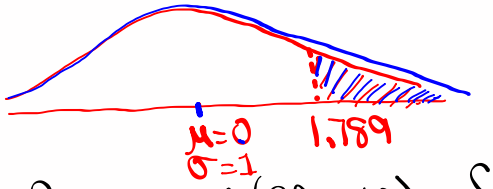
Statistics
Spring 2023
Lecture 38

Feb 19-8:47 AM

Class QZ 11

Drawing, labeling, shading, TI command required.

1) Find twice the area to the right of $Z = 1.789$



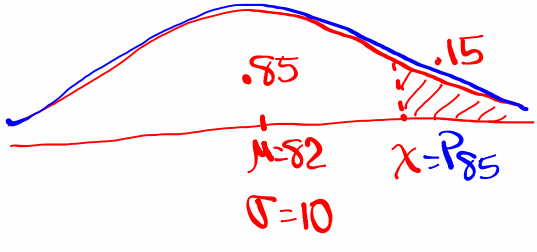
2*normalcdf(1.789, E99, 0, 1)

(L, U, μ, σ)

$= .074$ ✓

85% below, 15% above

2) Given $N(82, 10)$, find $x = P_{85}$, Round-up to a whole #



x=invNorm(.85, 82, 10)

$= 92.364$

≈ 93 ✓

Left Area

Apr 20-8:06 AM

Statistic → Describe Sample

Parameter → Describe Population

we use Statistic To estimate parameters

Estimation is a range of values that is called Confidence Interval.

Every estimation comes with some level of Confidence.

Confidence level is $(1-\alpha)\cdot 100\%$.

$0<\alpha<1$, α is called Significance level.

If $\alpha = .1 \Rightarrow (1-\alpha)\cdot 100\% = (1-.1)\cdot 100\% = 90\%$

If $\alpha = .05 \Rightarrow (1-\alpha)\cdot 100\% = (1-.05)\cdot 100\% = 95\%$

If $\alpha = .01 \Rightarrow (1-\alpha)\cdot 100\% = (1-.01)\cdot 100\% = 99\%$

If α not given:

Always use .05.

Apr 24-7:21 AM

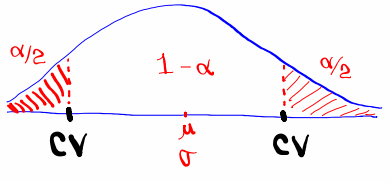
α → Significance level

$(1-\alpha)\cdot 100\%$ → Confidence level (C-level)

$1-\alpha$ is the middle area of the graph of Prob. dist.

The values that separate the middle area of the graph of prob. dist are called Critical Values.

The area on either side of Critical Values are $\alpha/2$.

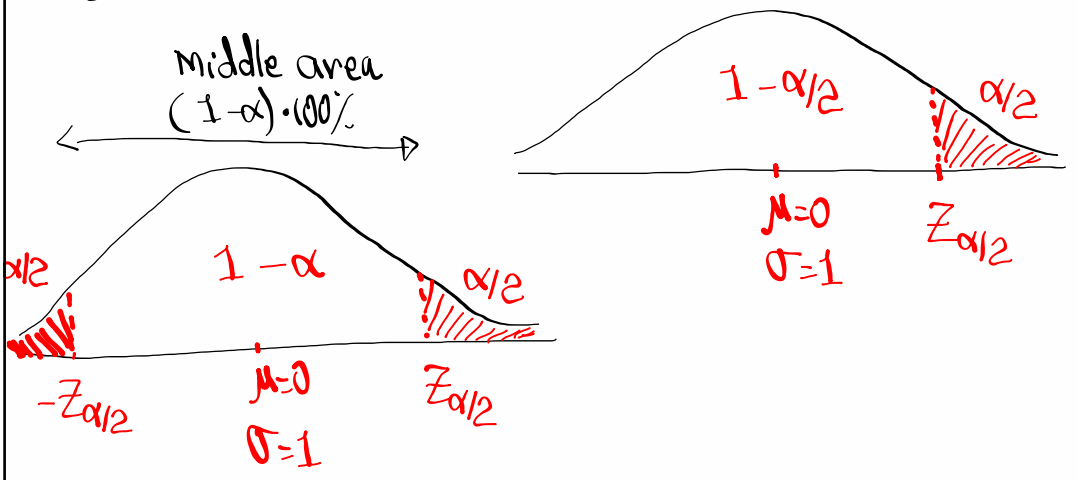


If α not given $\Rightarrow$ use .05

If C-level not given $\Rightarrow$ use 95%

Apr 24-7:28 AM

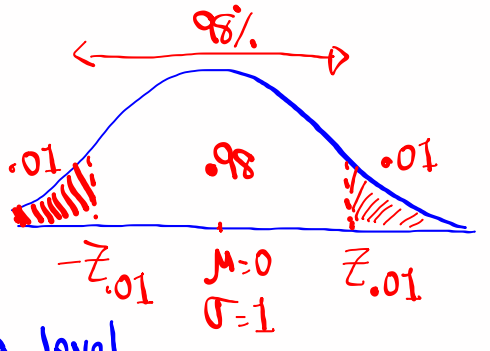
$z_{\alpha/2}$ is the value, rounded to 3-decimal places, that separates the **right area $\alpha/2$** from the rest.



Apr 24-7:35 AM

Find $z_{.01}$

- Right Area
- $1-.01=.99$ ↳ left Area



$\frac{\alpha}{2}=.01 \rightarrow \alpha=.02$ Sig. level

$(1-\alpha)\cdot 100\% = (1-.02)\cdot 100\% = 98\%$ C-level

$z_{.01} = \text{invNorm}(.99, 0, 1) = \boxed{2.326}$

Apr 24-7:39 AM

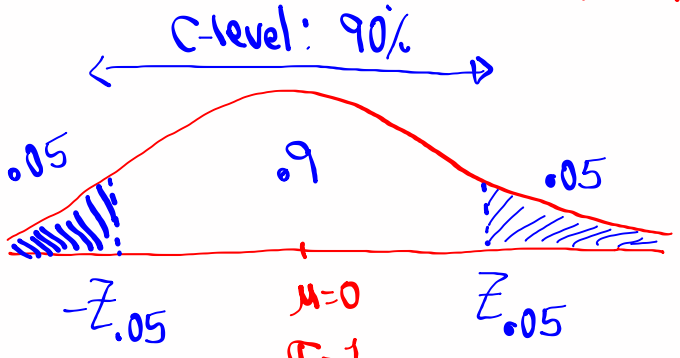
Find $z_{\alpha/2}$ for 90% C-level.

middle area = .9

$1 - .9 = .1$

$.1 \div 2 = .05$

$\alpha/2 = .05$



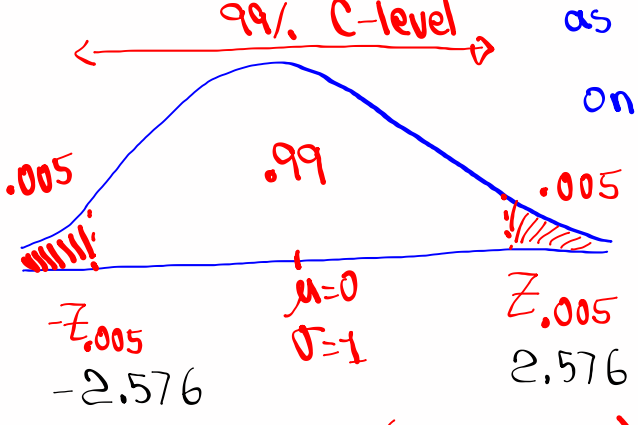
$z_{.05} = \text{invNorm}(.95, 0, 1)$

$= \boxed{1.645}$

Apr 24-7:43 AM

Find $z_{\alpha/2}$ for $\alpha = .01$.

$\alpha/2 = .01/2 = .005$ ← Area on the right side as well as the area on the left side.



$1 - \alpha = 1 - .01 = .99$ Middle area

C-level: 99%.

$z_{.005} = \text{invNorm}(.995, 0, 1) = \boxed{2.576}$

Apr 24-7:47 AM

Estimating Population Proportion

SG 22

p

$< p <$ This range of values is called Confidence Interval

$\hat{p} - E < p < \hat{p} + E$ $\hat{p} \rightarrow$ p-hat Sample Proportion "Point-Estimate" best guess

$E \rightarrow$ Margin of error

Suppose $\hat{p} = .42$ and $E = .05$

Confidence Interval $\rightarrow$ $\hat{p} - E < p < \hat{p} + E$

$.42 - .05 < p < .42 + .05$

$.37 < p < .47$

Apr 24-7:53 AM

Suppose 15% of a Sample ($\hat{p} = .15$) of students at College were left-handed. use margin of error ($E = .04$) of 4% to find Confidence interval for Proportion of all Students that are left-handed.

$\hat{p} - E < p < \hat{p} + E$

$.15 - .04 < p < .15 + .04$

$.11 < p < .19$

with Some degree of Confidence (C-level), we say between 11% and 19% of all College Students are left-handed.

Apr 24-7:59 AM

How to find $\hat{p}$:

$\hat{p}$ → Sample Proportion

$\hat{p}$ is the ratio of $\frac{x}{n}$

n → Sample Size

x → # of favorable responses

$\hat{p} = \frac{x}{n}$, Round to 3-decimal places.

ex: I surveyed 100 students, and 24 of them were smokers.

$n = 100$, $x = 24$ $\quad \hat{p} = \frac{x}{n} = \frac{24}{100} = \boxed{.24}$

$\hat{q} = 1 - \hat{p} = 1 - .24 = \boxed{.76}$

24% of survey were smokers.

76% " " " not smokers.

Apr 24-8:06 AM

I surveyed 400 adults and 125 of them were against abortion.

$n = 400$

$x = 125$

$\rightarrow \hat{p} = \frac{x}{n} = \frac{125}{400} = .313 \approx 31\%$

$\hat{q} = 1 - \hat{p} = 1 - .313 = .687 \approx 69\%$

using margin of error of 5%, find conf. interval for proportion of all that are against abortion.

$\hat{p} - E < p < \hat{p} + E$

$.313 - .05 < p < .313 + .05$

$.263 < p < .363$

$26\% < p < 36\%$

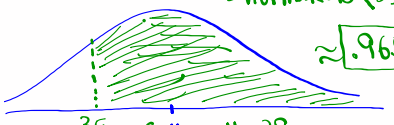
We say between 26% and 36% of all people are against abortion with some degree of confidence (C-level)

Apr 24-8:11 AM

Ages of nurses are normally dist. with $\mu = 39$ and $\sigma = 7$. $N(39, 7)$

If we randomly select $n = 10$ nurses find the prob. that their mean age $\bar{x}$ is above 35 yrs. $P(\bar{x} > 35)$

$= \text{normalcdf}(35, E99, 39, 7/\sqrt{10})$

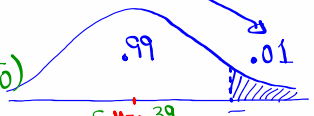


$\approx .965$

35

CLT $\begin{cases} \mu_{\bar{x}} = \mu = 39 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{7}{\sqrt{10}} \end{cases}$

Find $\bar{x}$ for randomly selected group of 10 nurses that separates the top 1% from the rest.



$\bar{x} = \text{invNorm}(.99, 39, 7/\sqrt{10})$

$= 44.150 \approx 44$

CLT $\begin{cases} \mu_{\bar{x}} = 39 \\ \sigma_{\bar{x}} = \frac{7}{\sqrt{10}} \end{cases}$

Apr 24-8:24 AM