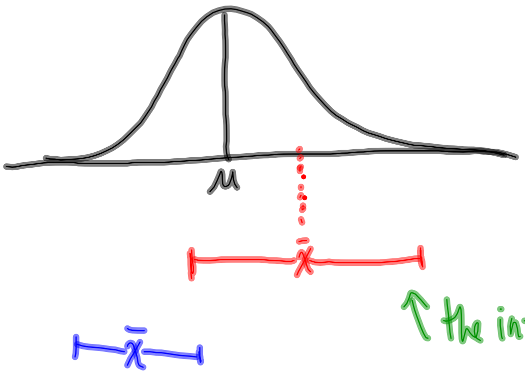
Confidence Intervals (continued)

Recall: A confidence interval is created by using the sample mean to make a guess as to what the population mean will be. An interval has a better chance of containing the population mean.

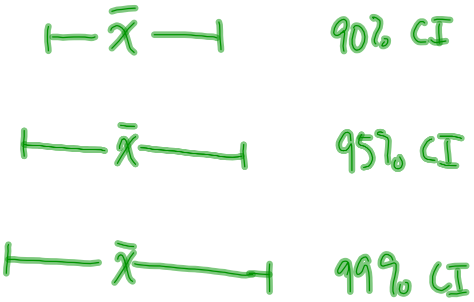


↑ the interval contains the pop. mean (μ)

↑ this interval does not contain μ

The interval can change depending on the sample and μ is fixed (does not change)

use wording: There is a ___% chance of the interval ___ to ___ containing the population mean.



The size of the CI increases. There is a better chance of the interval containing the mean with a higher CI

The sample mean, $\bar{x}$, is always the centre of the interval

$$\longleftarrow \bar{x} \longrightarrow$$

equal on either side

$$CI = \bar{x} \pm z\sigma_{\bar{x}} \quad \text{where: } \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

$$CI = \bar{x} \pm z\frac{\sigma}{\sqrt{n}}$$

$\bar{x}$ is the sample mean

σ is the pop stand. dev.

n is the sample size

z is the # of st. deviations away from the mean:

90% CI => $z = 1.645$

95% CI => $z = 1.96$

99% CI => $z = 2.576$

Example

A SRS of 96 NBA players was taken to determine the average heigh of professional basketball players. $\bar{x} = 71.7''$ and $S_x = 2.7''$. Determine an interval for μ with a 90% confidence level. $(z = 1.645)$

1.645 st. dev. above & below the sample mean:

Since the sample size is large we can say $S_x = \sigma$. We can use S_x as an estimate for σ

$$CI = \bar{x} \pm z\frac{\sigma}{\sqrt{n}}$$

$$CI = 71.7 \pm 1.645\frac{(2.7)}{\sqrt{96}}$$

$$CI = \underbrace{71.7}_{\text{point estimate}} \pm \underbrace{0.45}_{\text{margin of error}}$$

$$CI = 71.25 \text{ to } 75.15$$

or $CI = (71.25, 75.15)$

We are 90% confident that the average height of ALL NBA players is between 71.25" and 75.15"

using this method. ← SRS

Using the calculator:

```
EDIT CALC TESTS
4↑2-SampTTest…
5:1-PropZTest…
6:2-PropZTest…
7:ZInterval…
8:TInterval…
9:2-SampZInt…
0↓2-SampTInt…
```

use STATS to get this menu

```
TInterval
 Inpt:Data Stats
 x̄:71.7
 Sx:2.7
 n:96
 C-Level:.9
 Calculate
```

press enter

Then enter details + press calculate

```
TInterval
 (71.242,72.158)
 x̄=71.7
 Sx=2.7
 n=96
```

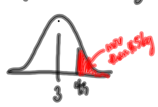
Write a statement to indicate the interval

Example

The average weight of a newborn baby in Canada in 1947 was $N(3, 0.6)$ kg.

normal ↗ μ σ

a) What % of babies born in 1947 would you expect to weigh more than 4.5kg?



$$z = \frac{x - \mu}{\sigma}$$

$$z = \frac{4.5 - 3}{0.6}$$

$$z = \frac{1.5}{0.6}$$

$$z = 2.5 \quad (0.9938)$$

$100\% - 99.38\% = 0.62\%$

There is a 0.62% chance of a baby born in 1947 weighing more than 4.5kg.

b) We think that babies are getting heavier because of better nutrition and pre-natal care. We take a SRS of 36 babies born in Canada in 2008 and get $\bar{x} = 3.4$kg and $S_x = 0.62$. Calculate a 99% Confidence Interval for the 2008 population of newborns in Canada.

n; use as σ; z=2.5

By Hand:

$$CI = \underbrace{\bar{x}}_{\text{point estimate}} \pm \underbrace{z\frac{\sigma}{\sqrt{n}}}_{\text{margin of error.}}$$

$$CI = 3.4 \pm 2.576\frac{(0.62)}{\sqrt{36}}$$

$$CI = 3.4 \pm 0.266$$

$$CI = (3.13, 3.67)$$

We are 99% confident that the average w of all babies born in Canada in 2008 is (3.13, 3.6 using this method.

This would indicate that newborn babies are, in fact, he in 2008 since the $\mu = 3$kg for 1947 is not con in this confidence interval.