Section 5.3: Point Estimates and Confidence

Wednesday, June 10, 2015
2:06 PM

statistical inference: making predictions or decisions about populations based on samples

predictions → we will be calculating something called an estimator

decisions → this is called "hypothesis testing" and we'll leave this for a later course

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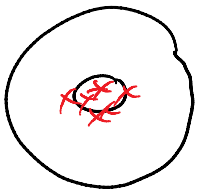
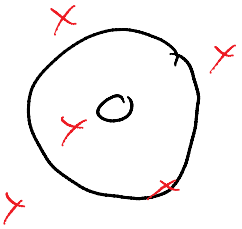
precision vs. accuracy:

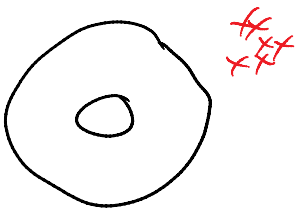
precise and accurate

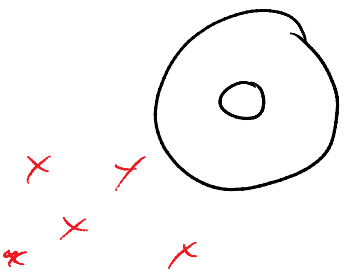




accurate but imprecise

precise but inaccurate





neither precise nor accurate

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when estimating the parameter (the mean, for example) of a population, you want your estimator to be unbiased

ie. accurate

and you want the spread to be as small as possible

ie. precise

confidence level:

99% confidence level
95% confidence level

what a 95% level means is that we expect the true value agrees with our estimate 95% of the time

Globe and Mail: "19 times out of 20"

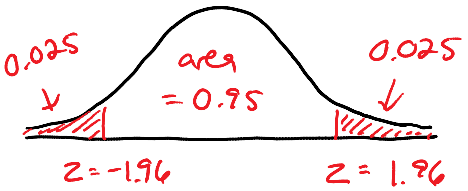
confidence coefficient: $1-\alpha$

$(1-\alpha)$ is the probability that your confidence interval will contain the true value you are trying to estimate

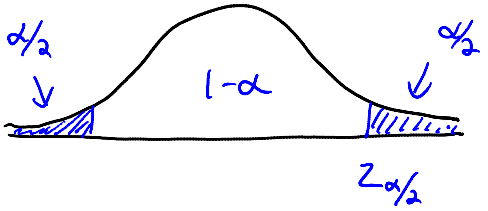
"I estimate that the water content of ethylene glycol produced by this factory is between 5 and 8 ppm with 95% confidence."

α itself is called the significance level

for 95% confidence:



in general:



confidence coeff $1-\alpha$	$z_{\alpha/2}$
0.90	1.645
0.95	1.96
0.98	2.33
0.99	2.58

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so, how do we estimate μ from $\bar{x}$ and s? ← standard dev of sample

estimate that $\mu = \bar{x} \pm \underbrace{MOE}_{\text{margin of error}}$

and to calculate MOE:

$$MOE = z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$$

central limit theorem

and if our sample is large enough we can estimate that $\sigma \approx s$

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example: A sample of 75 plots randomly chosen in BC's forests produced mean diameters for Douglas fir trees of 85 cm with a standard deviation of 12 cm. Estimate, then, the average diameter for Douglas fir trees in BC, including a margin of error.

→ if not otherwise specified assume a confidence

interval of 95% .

→ do we have a large sample? $n \geq 30$? yes

$$\mu = \bar{x} \pm MOE$$

$$= \bar{x} \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$$

$$= 85 \pm 1.96 \frac{(12)}{\sqrt{75}}$$

$$= 85 \pm \underbrace{2.71586}_{\text{ridiculous number of sigfigs}}$$

$$= 85 \pm 3 \text{ cm}$$

The average diameter of Douglas fir trees in BC is $\underbrace{85 \pm 3 \text{ cm}}_{\text{point estimator}}$

Confidence interval:

With 95% confidence the average diameter of Douglas fir trees in BC is between 82 and 88 cm.