Confidence Intervals and Hypothesis Tests with Bootstrapping

Coming up…

- Lab Assignment 6 is due **Thursday just before your lab section time.**

- Peer Evaluations is due **Thursday 2/28 11:55pm** *(part of your participation grade)*

- Read over project statement before **Thursday 2/28**

  (see Sakai Resources)

- Project Stage 1 is due **Thursday 3/7**

MT1 Tip

New Zealand wages MC problems:

- Review the last few problems on the MT1 Review slides

Remember…
If a random variable $\square \sim N(mean_{\square}, SD_{\square})$, then

$$\frac{\square - mean_{\square}}{SD_{\square}} \sim N(0,1)$$

1. If $X \sim N(mean = \mu, standard\ dev = \sigma)$,

$$P(x > \#) = \mathrm{P}\left(Z > \frac{\# - \mu}{\sigma}\right)$$ Use z-tables

Aka: **standard error** = standard deviation of the sampling distribution.

2. If CLT conditions met, then $\bar{x} \sim N\left(mean = \mu, standard\ dev = \frac{\sigma}{\sqrt{n}}\right)$, so:

$$P(\bar{x} > \#) = \mathrm{P}\left(Z > \frac{\# - \mu}{\sigma/\sqrt{n}}\right)$$ Use z-tables

MT1 Tip

New Zealand wages MC problems:

- Review the last few problems on the MT1 Review slides

A housing survey was conducted to determine the price of a typical home in Topanga, CA. The mean price of a house was roughly \$1.3 million with a standard deviation of \$300,000. There were no houses listed below \$600,000 but a few houses above \$3 million.

What is the probability that the mean of 60 randomly chosen houses in Topanga is more than \$1.4 million?

In order to calculate $P(\bar{X} > 1.4 \text{ mil})$ we need to first determine the distribution of $\bar{X}$. According to the CLT,

$$\bar{X} \sim N\left(mean = 1.3, SE = \frac{0.3}{\sqrt{60}} = 0.0387\right)$$

Remember…
If a random variable □~N($mean_{□}$, $SD_{□}$), then
$\frac{□ - mean_{□}}{SD_{□}} \sim N(0,1)$

$$P(\bar{X} > 1.4) = P\left(Z > \frac{1.4 - 1.3}{0.0387}\right) \quad \text{Z-table}$$

$$= P(Z > 2.58) = 1 - P(Z \leq 2.58)$$

$$= 1 - 0.9951$$

MT1 Tip

Bass Fishing Competition Problem:

- Review Application Exercises 2.3 #4

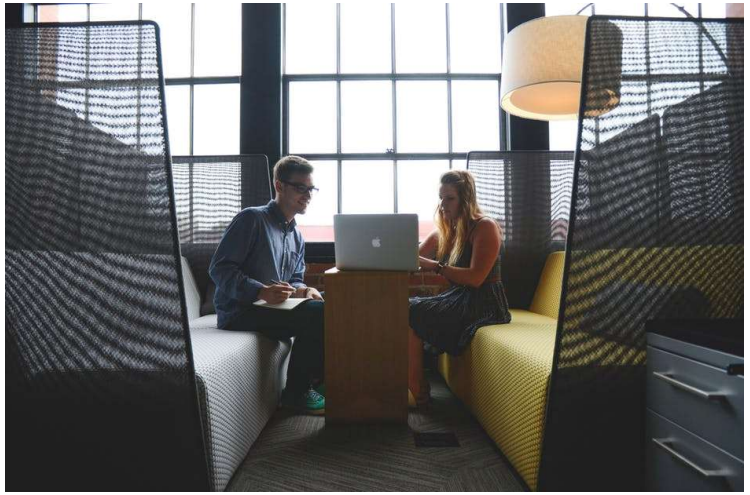
4. Suppose that a worker applies for a manufacturing job in North Carolina, and receives the good news that she got the job and that her pay will be at least $16.50 per hour. She would really like to be able to make at least $17 per hour. What is the probability that she will get what she wants? Assume that the company she will be working for is a run-of-the-mill manufacturing company in NC, i.e. the distribution of the hourly wages at this company reflects the state distribution. *Hint:* This is a conditional probability.

Given: $X_{NC} \sim N(\mu = 15.85, \sigma = 1.11)$

$$P(X_{NC} > 17 \mid X_{NC} > 16.50) = \frac{P(X_{NC} > 17 \text{ and } X_{NC} > 16.50)}{P(X_{NC} > 16.50)} = \frac{P(X_{NC} > 17)}{P(X_{NC} > 16.50)}$$

$$= \frac{0.15}{P\left(Z > \frac{16.50 - 15.85}{1.11}\right)} = \frac{0.15}{P(Z > 0.59)} = \frac{0.15}{0.28} = 0.53$$

Private Tutoring with Statistics Graduate Students



https://stat.duke.edu/undergraduate/current-students/course-help

Recap… what we can do so far…

	Do we know how to create a confidence interval/hypothsis test yet? If so, how?	
Population Parameter	**Confidence Interval**	**Hypothesis Testing**
$\mu_1-\mu_2$	CLT Confidence Interval (Unit 4)	Randomization Testing (Unit 1) CLT Hypothesis Testing (Unit 4)
p_1-p_2		Randomization Testing (Unit 1)
$Median_1-Median_2$		Randomization Testing (Unit 1)
μ	CLT Confidence Interval (Unit 3 and 4)	CLT Hypothesis Testing (Units 3 and 4)
μ_{diff}	CLT Confidence Interval (Unit 4)	CLT Hypothesis Testing (Units 3 and 4)
Median		
p		

What we can do after today…

	Do we know how to create a confidence interval/hypothsis test yet? If so, how?	
Population Parameter	**Confidence Interval**	**Hypothesis Testing**
$\mu_1-\mu_2$	CLT Confidence Interval (Unit 4)	Randomization Testing (Unit 1) CLT Hypothesis Testing (Unit 4)
p_1-p_2		Randomization Testing (Unit 1)
$Median_1-Median_2$		Randomization Testing (Unit 1)
μ	CLT Confidence Interval (Unit 3 and 4) Bootstrap Confidence Interval (Unit 4)	CLT Hypothesis Testing (Units 3 and 4) Bootstrap Hypothesis Testing (Unit 4)
μ_{diff}	CLT Confidence Interval (Unit 4) Bootstrap Confidence Interval (Unit 4)	CLT Hypothesis Testing (Units 3 and 4) Bootstrap Hypothesis Testing (Unit 4)
Median	Bootstrap Confidence Interval (Unit 4)	Bootstrap Hypothesis Testing (Unit 4)
p	Bootstrap Confidence Interval (Unit 4)	Bootstrap Hypothesis Testing (Unit 4)

Reminder…

- If we know σ, use z-distribution.
- If we don’t know σ, use t-distribution.