5) Statistical Test

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Reference

Tables, Graphics, and Figures from

Introductory Statistics with

Randomization and Simulation

Diez et al. (2014): Ch 2 - Foundation for inference

Rosen B and Jerdee T. 1974. "Influence of sex role stereotypes on personnel decisions." Journal of Applied Psychology 59(1):9-14

CVs were randomly assigned to 48 male bank supervisors

CVs were identical, except that half was male and the other half female

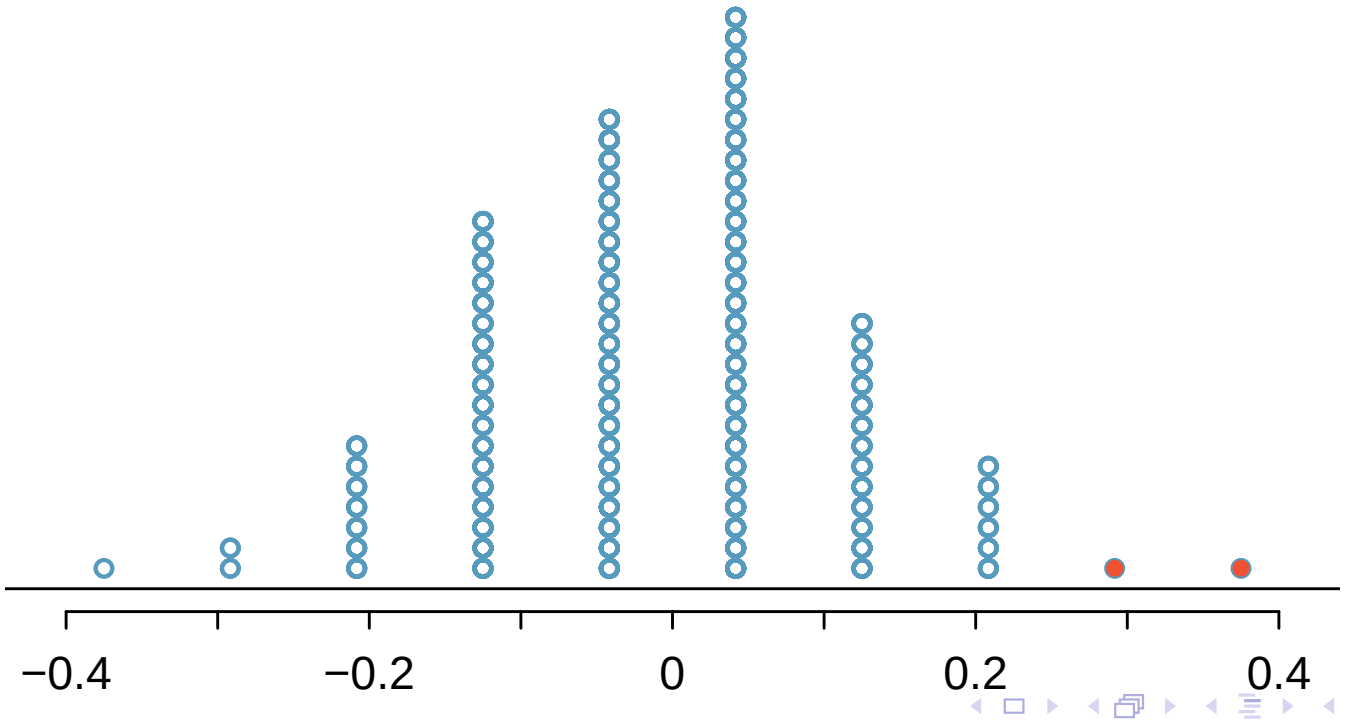
H_0: Gender $\perp$ Decision vs H_A: Gender $\neg \perp$ Decision

		decision		
		promoted	not promoted	Total
gender	male	21	3	24
	female	14	10	24
	Total	35	13	48

$$\frac{21}{24} - \frac{14}{24} = 29.2\%$$

100 Simulations

		decision		
		promoted	not promoted	Total
gender_simulated	male	18	6	24
	female	17	7	24
	Total	35	13	48



Medical Consultant

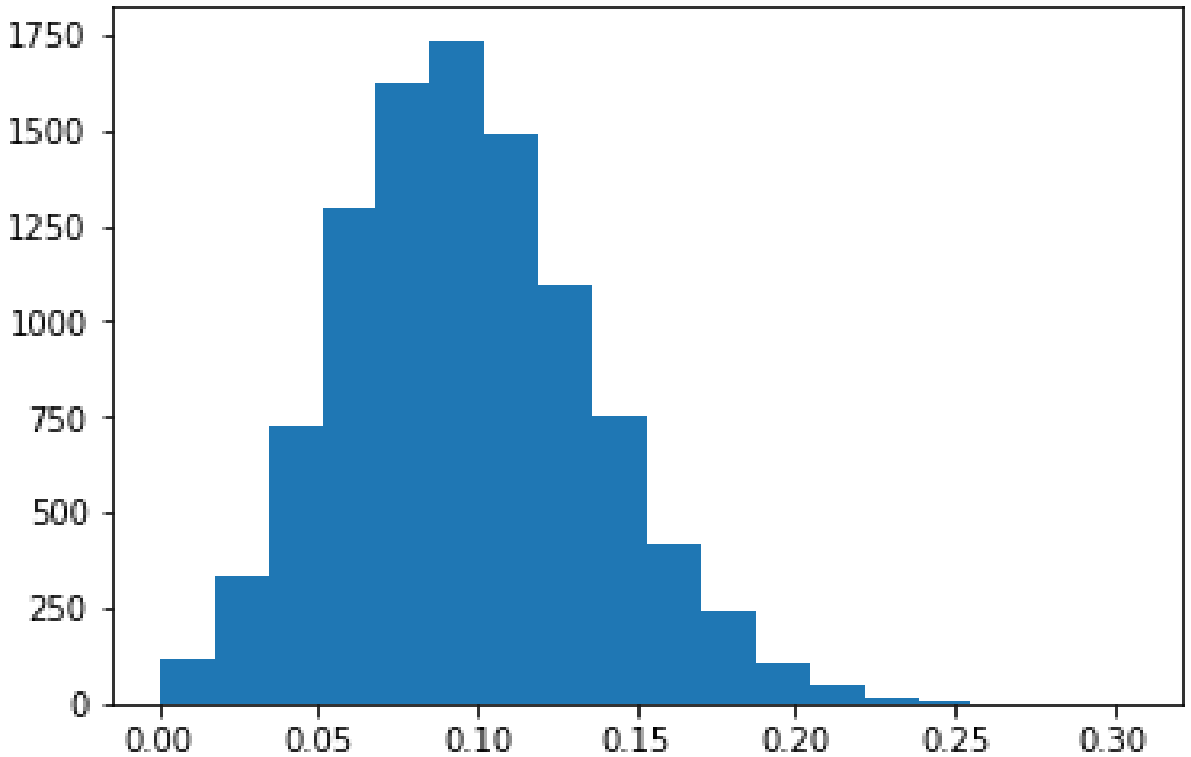
Average complication rate for liver donor surgeries in the US is about 10%

A Medical Consultant had only 3 complications in the 62 liver donor surgeries $\hat{p} = \frac{3}{62} \cong 0.048$

```
import numpy as np

np.random.seed(77)

pHat = np.random.binomial(62, 0.1, size=10000)/62

sum(pHat < 0.048)/10000
```

10000 Simulations

```
import matplotlib.pyplot as plt
plt.hist(pHat, bins=18)
```



$\hat{p} < 0.048 = 0.0449$

95% Confidence Interval for a Proportion (p)

$$SE = \sqrt{\frac{p(1-p)}{n}} \cong \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{0.048(1-0.048)}{62}}$$

$$p \pm z * SE$$

$$0.048 \pm 1.96 \times 0.02725$$

$$[-0.005 \textbf{ to } 0.10]$$

$$ME = z * SE = 0.0534$$

Decision Errors

		Test Conclusion	
		do not reject H_0	reject H_0
Truth	H_0 true	okay	Type 1 Error
	H_A true	Type 2 Error	okay

Hypothesis Test for a Proportion (p)

$$H_0 : p \geq 0.1 \textbf{ vs } H_a : p < 0.1$$

$$SE = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.1(1-0.1)}{62}} = 0.038$$

$$z = \frac{\hat{p}-p}{SE} = \frac{0.0484-0.1}{0.038} = -1.35$$

$$P(z < -1.35) = 0.0875$$

Frederick S and et. al. 2009. Opportunity Cost Neglect. Journal of Consumer Research 36: 553-561.

Control Group:

(A) Buy this entertaining video.

(B) Not buy this entertaining video.

Treatment Group:

(A) Buy this entertaining video.

(B) Not buy this entertaining video. Keep the \$14.99 for other purchases.

Opportunity Cost

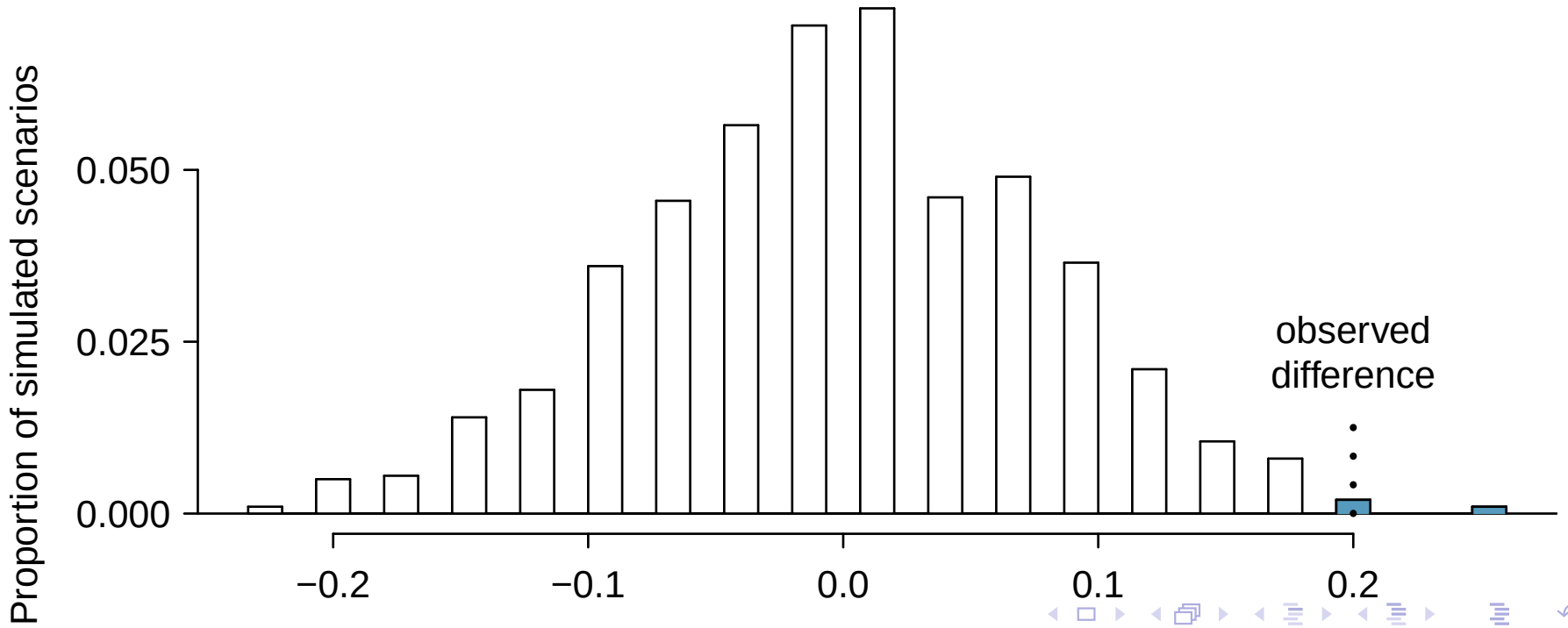
	decision		
	buy DVD	not buy DVD	Total
control group	56	19	75
treatment group	41	34	75
Total	97	53	150

	decision		
	buy DVD	not buy DVD	Total
control group	0.747	0.253	1.000
treatment group	0.547	0.453	1.000
Total	0.647	0.353	1.000

$$\hat{p}_t - \hat{p}_c = \frac{34}{75} - \frac{19}{75} = 20\%$$

1000 Simulations

	decision		
	buy DVD	not buy DVD	Total
simulated-control group	46	29	75
simulated-treatment group	51	24	75
Total	97	53	150



Framing Effect

AAUP-AFT, Local 6075 (*American Association of University Professors-American Federation of Teachers*)

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