

Lecture 7 HW - Key

1. (a) $\hat{p} = .2$ $\sigma_{\hat{p}} = \sqrt{\frac{.2(.8)}{100}} = .04$

- Survey is likely given to random subscribers
- Reasonable to assume that the company has at least 1000 subscribers (10% condition)
- Sample is likely independent
- $100 \cdot .2 = 20 \checkmark$
- $100 \cdot .8 = 80 \checkmark$

CONDITIONS MET

$\sim N(.2, .04)$

(b) $z = \frac{.25 - .2}{.04} = 1.25$

$P(z > 1.25) = \underline{\underline{.1056}}$

2. (a) $\hat{p} = .48$ $\sigma_{\hat{p}} = \sqrt{\frac{(.48)(.52)}{400}} = .025$

- No evidence that the sample was random
- Reasonable to assume that there are at least 400 drivers in Tulsa.
- Independence of the sample is unclear
- $400 \cdot .48 = 192 \checkmark$
- $400 \cdot .52 = 208 \checkmark$

CONDITIONS NOT MET - PROCEED W/ CAUTION

$z = \frac{.45 - .48}{.025} = -1.2$ $z = \frac{.55 - .48}{.025} = \underline{\underline{2.8}}$

$P(-1.2 < z < 2.8) = .882$

$$3. \textcircled{a} \hat{p} = .35$$

$$\sigma_{\hat{p}} = \sqrt{\frac{(.35)(.65)}{100}} = .048$$

- Contact is made randomly
- Sufficiently large number of nurses so that.
100 is almost certainly less than 10% of the population.
- Sample is likely independent
- $100 \cdot .35 = 35 \checkmark$
- $100 \cdot .65 = 65 \checkmark$

CONDITIONS HAVE BEEN MET

$$z = \frac{.4 - .35}{.048} = 1.042$$

$$P(z > 1.04) = \underline{.1492}$$

4. 1 sample z-test for proportions

$$H_0: p = .058$$

$$H_a: p < .058$$

p is the true proportion of all job applicants who were drug tested & failed the test

Random \rightarrow SRS \checkmark

Independence of sample is reasonable

Likely that 1520 job applicants represents less than 10% of the population

$$1520 \cdot .058 = 88.16 \checkmark$$

$$1520 \cdot .942 = 1431.84 \checkmark$$

CONDITIONS MET

$$\mu_{\hat{p}} = .058 \quad \sigma_{\hat{p}} = \sqrt{\frac{(.058)(.942)}{1520}} = .006$$

$$\sim N(.058, .006)$$

$$\hat{p} = \frac{58}{1520} = .0382$$

$$z = \frac{.0382 - .058}{.006} = -3.3$$

$$P(Z < -3.3) = .0005 \leftarrow p\text{-value}$$

We reject H_0 , as the p -value, .0005, $< \alpha = .01$.

There is evidence that the true proportion of all job applicants who were drug tested & failed the test is less than .058.

5. 1 sample Z-test for Proportions

$$H_0: p = .85$$

$$H_a: p > .85$$

p is the true proportion of the population of American adults that eat salad at least once a week.

- We'll assume that the nutritionist conducted a random sample
- 200 is much less than size of the adult American population
- No indicator that samples weren't independent
- $200 \cdot .85 = 170 \checkmark$
- $200 \cdot .15 = 30 \checkmark$

ASSUMING RANDOMIZATION + INDEPENDENCE, CONDITIONS ARE MET

$$\mu_{\hat{p}} = .85$$

$$\sim N(.85, .025)$$

$$\sigma_{\hat{p}} = \sqrt{(.85)(.15)} = .025$$

$$\hat{p} = 171/200 = .855$$

$$Z = \frac{.855 - .85}{.025} = .2$$

$$P(Z > .2) = .421 \quad \leftarrow \text{p-value}$$

We fail to reject H_0 , as the p-value, .421, is greater than α of .05. There is no evidence that the true proportion of the population of American adults that eat salad at least once a week is greater than .85.