PSY30100-03 -- Assignment 6

Chapter 6:

Introduction to Inference

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Question 1: 6.50 (p.390)

- What's wrong?
- (a) $n = 20, \sigma_x = 12, \sigma_{\bar{x}} = \frac{12}{20}?$

Ans: The s.d. of the sample mean is

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{12}{\sqrt{20}}$$

Question 1: 6.50 (p.390)

- What's wrong?

- (b) $H_0 : \bar{x} = 10$

Ans: The null hypothesis should be a statement about the population parameter(s), not the sample statistic(s).

Here, the researcher should test μ .

Question 1: 6.50 (p.390)

- What's wrong?

- (c) A study with $\bar{x} = 48$ reports statistical significance for $H_a: \mu > 54$.

Ans: $\bar{x} = 48$ would not make us inclined to believe that $\mu > 54$.

Question 1: 6.50 (p.390)

- What's wrong?

- (d) A researcher tests $H_0 : \mu = 50$ and concludes that the population mean is equal to 50.

- Ans: Even if we fail to reject the H0, we are not sure if H0 is true.

  "fail to reject H0" is different from "know that H0 is true".

  Lack of evidence for rejecting a hypothesis does not imply that we have evidence to support this hypothesis.

Question 2: 6.52b; 6.55 (p.391)

- The alternative hypothesis Ha is the statement we hope or suspect is true instead of H0.

- Usually the null hypothesis H0 is a statement of "no effect", "no difference" or "is equal to".

- (6.52b) The professor believes that the mean μ for the morning class will be higher, so we test

$$H_0 : \mu = 72 \quad vs. \quad H_a : \mu > 72$$

Question 2: 6.52b; 6.55 (p.391)

- 6.55 (a)

$$H_0: \mu = \$62,500 \quad vs. \quad H_a: \mu > \$62,500$$

- 6.55 (b)

$$H_0: \mu = 2.6\, hours \quad vs. \quad H_a: \mu \neq 2.6\, hours$$

Question 3: 6.56 (p.391)

- Computing the P-value:

- The P-value is the area under the sampling distribution for values at least as extreme, in the direction of *Ha*, as that of our random sample.

- In order to obtain the P-value, we need
  (1) Z value (2) Ha (direction of Ha)

- For different Ha, the direction of Ha is different, so the P-value is different.

Question 3: 6.56 (p.391)

- Computing the P-value for

$$H_0 : \mu = \mu_0$$

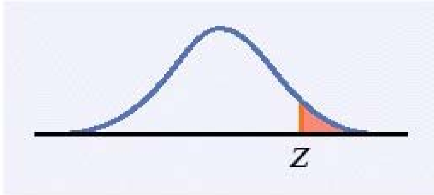
- (a) $H_a : \mu > \mu_0$
- (b) $H_a : \mu < \mu_0$
- (c) $H_a : \mu \neq \mu_0$

(P.383, our textbook)

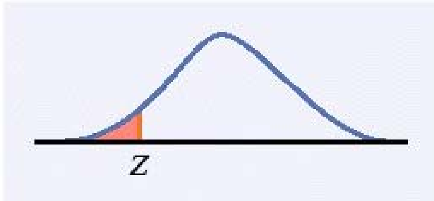
One-sided test

(one-tailed test)

$H_a: \mu > \mu_0$ is $P(Z \geq z)$



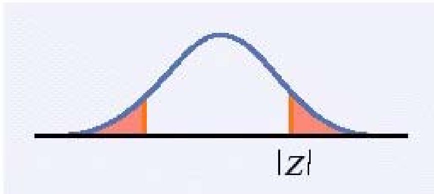
$H_a: \mu < \mu_0$ is $P(Z \leq z)$



Two-sided test

(two-tailed test)

$H_a: \mu \neq \mu_0$ is $2P(Z \geq |z|)$



To calculate the P-value for a two-sided test, use the symmetry of the normal curve. Find the P-value for a one-sided test and double it.

Question 3: 6.56 (p.391)

- Computing the P-value for

$$H_0 : \mu = \mu_0$$

- (a) $the\ P-value\ is\ P(Z \geq z = 1.34) = 0.0901$
- (b) $the\ P-value\ is\ P(Z \leq z = 1.34) = 0.9099$
- (c) $the\ P-value\ is$

$$2 \times P(Z \geq z = 1.34) = 2 \times 0.0901 = 0.1802$$

Question 4: 6.58 (p.392)

- A two-sided test and the confidence interval.

- "A level α two-sides significance test rejects $H_0: \mu = \mu_0$ exactly when the value μ_0 falls outside a level $1-\alpha$ confidence interval for μ."

  (p.392, our textbook)

Question 4: 6.58 (p.392)

- A two-sided test and the confidence interval.
- (a) Ans: No.

  30 is not in the 95% confidence interval because P=0.04 means that we would reject H0 at $\alpha = 0.05$.
- (b) Ans: No.

  30 is not in the 90% confidence interval because we would also reject H0 at $\alpha = 0.10$ with P=0.04.

Question 5: 6.64 (p.392)

- (Change in California's eighth-grade average science score)

- (You may have your own answers) Even if the actual mean score had not changed over time, random fluctuation might cause the mean in 2005 to be different from the mean in 2000. However, in this case the difference was so great that it is unlikely to have occurred by chance; specially, such a difference would arise less than 5% of the time if the actual mean had not changed. We therefore conclude that the mean did change from 2000 to 2005.

Question 6: 6.68 (p.393)

- (Who is the author?)

$$H_0 : \mu = 8.9 \quad vs. \quad H_a : \mu > 8.9$$

$$\sigma = 2.5$$

$$\bar{x} = 10.2$$

$$n = 6$$

$Z = ?$

$P = ?$

$Conclusion?$

The Z test

To test the hypothesis $H_0 : \mu = \mu_0$ based on an SRS of size n from a Normal population with unknown mean μ_0 and known standard deviation σ, we rely on the properties of the sampling distribution $N(\mu_0, \sigma/\sqrt{n})$.

We first calculate a z-value and then use Table A.

$$z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

The P-value is the area under the sampling distribution for values at least as extreme, in the direction of *Ha*, as that of our random sample.

Question 6: 6.68 (p.393)

- (Who is the author?)

$$Z = \frac{\overline{x} - \mu}{\sigma / \sqrt{n}} = \frac{10.2 - 8.9}{2.5 / \sqrt{6}} \approx 1.27$$

$$P = P(Z > 1.27) = 0.1020$$

which means it is not significant at the level of 0.05 or even 0.1, so we can not reject H0.

- Conclusion: There is no enough evidence to reject that these sonnets were written by our poet.