Economics 2740
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P-Values

Suppose that you want to test:

$H_0: \mu \leq \mu_0$, $H_A: \mu > \mu_0$, $\alpha = 0.05$

•Consider the following z values:

(i) $z = 0.02 \quad \rightarrow \{< Z_\alpha \}$

(ii) $z = 1.60$

(iii) $z = 1.70 \rightarrow \{> Z_\alpha\}$

(iv) $z = 3.0$

•Hyp. test doesn't tell us strength of evidence against H_0

- P-value = Prob of getting z-value as large or larger if $\mu = \mu_0$

  = smallest significance level at which we can reject H_0

  = "observed significance level"

Let $X_i, \ldots X_n \sim N(\mu, \sigma^2)$, where σ^2 known.

- $\xi \sim N(0,1)$ R.V. $(\xi \equiv X_i)$

A. $H_0: \mu \leq \mu_0 \quad H_a: \mu > \mu_0$

P-val = Prob $(\xi \geq Z)$

[See Graph in Class]

B. $H_0: \mu \geq \mu_0$, $H_a: \mu < \mu_0$

P-value = Prob ($\xi \leq Z$)

[See graph in class]

C. $H_0: \mu = \mu_0$, $H_a: \mu \neq \mu_0$

P-value = Prob($|\xi| \geq Z$)

[See graph in class]

Problems

1. $X_1,\ldots X_6 \sim$ iid $N(\mu, 24)$

   $\bar{X} = 55$

   $H_0: \mu \leq 50$ $H_a: \mu > 50$

   Find P-value

Solution: [See graph in class]

a) Calculate Z

$z = (55 - 50)/2 = 2.5$

b) Look up

Prob(z >2.5) = 0.0062

P-value = 0.0062

3. $X_1,\ldots X_n \sim N(\mu, 4)$

$H_0: \mu \leq 0 \quad H_a: \mu > 0$

$\bar{X} = 1$

P-value = 0.10

Find n

$\rightarrow$Soln: a) use p-value to look up z

[see graph in class]

b) solve for n

$1.28 = z = (\bar{X} - \mu)/[\sigma^2/(n)^{1/2}]$

$1.28 = 1/[2/(n)^{1/2}] = (n)^{1/2}/2$

$(n)^{1/2} = 2(1.28) \Rightarrow$ ***n = 6.55***

4. P-value = 0.07

   Can we reject H_0 for

   (i) $\alpha = 0.05$?

   (ii) $\alpha = 0.10$?

[See graph in class]

(i) No, can't reject for $\alpha = 0.05$

(ii)Yes, can reject for $\alpha = 0.10$

2. Two sided p-val.

$X_1, \ldots X_6 \sim$ iid $N(\mu, 24)$

$\bar{X} = 55$

$H_0: \mu = 50 \quad H_a: \mu \neq 50$

Find P-value

[Solution: See graph in class]

P-value $= P(|z| > 2.5)$

$= P(z < -2.5) + P(z > 2.5)$

$= 2 \cdot 0.0062 =$ ***0.0124***