# Homework 4 SET 7

10.1 #23

a) $H_0 = \mu < 30{,}000$

$H_A = \mu > 30{,}000$

Type I Error

Tires could wear out before the warranty, costing the company money

Type II

The company spends more money on each tire to prevent warrenty claims when they didnt need to.

b) $H_0 \leq 240$
$H_A > 240$

Type I

The company redesigns bar to give too soon, reducing the tools usefullness

Type II

Bar could give too late causing safety issues

c) $H_0: \bar{x} \geq 7$

$H_A: \bar{x} < 7$

Type I

company spends money on new scanners that do not result in the expected efficiency gains.

Type II

company loses out on potential efficiency gains.

---

10.2 #6

a) CV: $-2.326$

b) CV: $2.05$

c) CV: $(-1.75, 1.75)$

10.2 # 8

$\mu = 4100$

$n = 200$

$\alpha = 0.01$

$\bar{x} = 4117$  $s = 300$

$H_A: \mu > 4100$

$H_0: \mu \leq 4100$

$$\frac{4117 - 4100}{\left(\frac{300}{\sqrt{200}}\right)} = 0.801$$

$p = 0.2119$

$$\boxed{\underbrace{0.2119 > 0.01}_{p \, > \, \alpha}}$$

Fail to reject the null

---

10.2 # 10

$H_0: \mu = 24000$  $n = 84$

$H_A: \mu > 24000$  $\bar{x} = 27,500$

$s = 2400$

10.2 # 10 cont.

a.) average hurricane claim

b) population mean

c) Average hurricane claim size will be greater than 24,000.

d.) $\alpha = 0.01$ $H_0: \mu = 24000$ $n = 84$

$H_A: \mu > 24000$ $\bar{x} = 27{,}500$

$s = 2400$

$$\frac{27500 - 24000}{\left(\frac{2400}{\sqrt{84}}\right)} = 13.366$$

$\alpha = 0.01$

$CV = 2.326$

$H_A > H_0$

$13.366 > 2.326$

Reject the null, Claim size is greater than historical average with $\alpha = 0.01$ level of significance.

10.2 # 12

a) $H_0 = \mu = 45$ $\alpha = .05 \rightarrow \frac{\alpha}{2} = .025$

$H_A = \mu \neq 45$ $s = 10$

$\bar{x} = 47$ $n = 125$

$$\frac{47-45}{\left(\frac{10}{\sqrt{125}}\right)} = 2.236 = z \quad p = 0.0125$$

$p < \alpha$

$0.0125 < 0.025$

Reject the null
Sufficient evidence at $\alpha = 0.05$
that the mean of the population is not
45 minutes.

b) $\frac{\alpha}{2} = 0.025 \rightarrow CV = 1.960$

$$-1.960 = \frac{\bar{x} - 45}{\left(\frac{10}{\sqrt{125}}\right)}$$

$$-1.960\left(\frac{10}{\sqrt{125}}\right) + 45 = \bar{x}$$

$\bar{x} = 43.2$

10.2 # 14

$\mu = 1$

$s = 0.3$ $\quad H_A \to \mu < 1$

$n = 45$

$\bar{x} = 0.9$

$\alpha = 0.05$

$$\frac{0.9-1}{\left(\frac{0.3}{\sqrt{45}}\right)} = z = -2.236$$

$p = 0.0125$

$p < \alpha$

$0.0125 < 0.05$

Reject Null

There is sufficient evidence at $\alpha = 0.05$ level of confidence that the average growth rate is less than 1 cm per day.

10.2 # 16

$H_0 \to \mu \geq 5$ $\bar{x} = 4.85$

$s = 0.3$ $\alpha = 0.01$

$H_A \to \mu < 5$ $n = 300$

$$\frac{4.85 - 5}{\left(\frac{0.3}{\sqrt{300}}\right)} \Rightarrow t = -8.66$$

$p < 0.002$

$p < \alpha$

$0.002 < 0.01$ Reject the Null

At $\alpha = 0.01$ level of significance there is sufficient evidence to suggest that the average concentration is below 5 ppb

10.2 # 18

$\mu_0 = 10$

$H_A \rightarrow \mu < 10$

$n = 1000$

$\bar{x} = 9.36$

$s = 0.5$

$\alpha = 0.05$

$$\frac{9.36 - 10}{\left(\frac{0.5}{\sqrt{1000}}\right)} \approx -40.477 = t$$

$p \approx 0$

$p < \alpha$

Reject null

$0 < 0.05$

At $\alpha = 0.05$ there is sufficient evidence to suggest that brand X dries faster than 10 minutes.

10.2 #19

a) $p = 0.0935$
$\alpha = 0.1$ Reject Null

b) $p = 0.0311$ $\alpha = 0.05$
Reject Null

c) $p = 0.0545$ $\alpha = 0.01$
$p > \alpha$
Fail to reject Null

d) $0.0459$ $\alpha = 0.05$

$p < \alpha$
Reject Null

---

10.2 #20 $\alpha = 0.05$

A) $H_A: \mu > \mu_0$ $z = 1.58$ $p = 0.0571$
Fail to reject

B) $H_A: \mu \neq \mu_0$ $z = 1.90$ $p = 0.0287$
$\alpha/2 = 0.025$
Fail to reject

c) $H_A: \mu < \mu_0$ $z = -2.25$ $p = 0.0122$ $\alpha = 0.05$
$p < \alpha$
Reject Null

10.3 # 8

A) Left-tail $\alpha = .005$ $n = 12$ $df = 11$

$CV = -3.106$

B) Right $\alpha = 0.025$ $n = 5$ $df = 4$ $t =$

$CV = 2.776$

C) Two-tail $\alpha = 0.10$ $\frac{\alpha}{2} = 0.05$ $n = 25$ $df = 24$

$CV = (-1.711, 1.711)$

---

10.3 # 10

$H_A: \mu > 100$ $\alpha = 0.05$

100, 150, 120, 90, 95, 110, 80

$\bar{x} = 105.625$

$$\sum \sqrt{\frac{(x_i - \bar{x})^2}{n}} = s$$

$s = 21.62$

$$t = \frac{105.625 - 100}{\frac{21.62}{\sqrt{8}}} = 0.737$$

$p = 0.2296$

$0.2296 > \alpha$

$p > \alpha$ ] Fail to Reject

10.3 # 12

$\mu = 14{,}400$ $n = 16$ $df = 15$

a) Nur Star computer drives

b) Time to failure

c) Interval / Ratio

d) $\alpha = 0.01$ $df = 15$

$CV = -2.602$

$\bar{x} = 10800$
$s = 8340$

$$\frac{10800 - 14400}{\frac{8340}{\sqrt{16}}} = -1.727$$

Fail to reject null

e) Approx normal population distribution

10.3 # 16

$n=25$  $df=24$  $\alpha$

$\bar{x}=107$  $\mu_0=100$
$s=23$

$H_A: \mu > 100$

$$\frac{107-100}{\frac{23}{\sqrt{25}}} = 1.522 = t$$

a) $\alpha = 0.10$  $df=24$  $CV = 1.318$

Reject Null b/  $\underset{H_A}{1.522} > \underset{H_0}{1.318}$
He should develop
the land.

b) That the distribution of visitors per day
is approximately normal

10.3 # 18

$H_0: \mu = 5$ $\quad$ $n = 50$ $\quad$ $\alpha$

$\bar{x} = 3.5$

$H_A = \mu \leq 5$ $\quad$ $s = 1.5$

$$\frac{3.5 - 5}{\frac{1.5}{\sqrt{50}}} = -7.07 = z$$

$p \approx 0.0002$ $\quad$ $\alpha = 0.05$

Reject Null

At $\alpha = 0.05$ level of significance there is sufficient evidence to suggest that the time per move has been below 5 minutes for the last two years

# Homework 4 SET 8

10.5 prob 5

$\alpha = 0.05$

a. $-1.645$

b) $2.326$

c) $-1.645, 1.645$

---

10.5 #7) $p = 38\%$ $n = 300$

$\hat{p} = \frac{148}{300}$ $\alpha = 0.01$

C.V. $= 3.08$ $\hat{p} = 0.493$

$$2.33 \quad \frac{\hat{p}(\hat{p} - p)}{n}$$

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

$$z\left(\frac{p_0(1-p_0)}{n}\right)^{1/2} + p_0 = \hat{p}$$

$$2.33\left(\frac{0.38(0.62)}{300}\right)^{1/2} + 0.38 = 0.445 \quad \hat{p} \text{ at C.V.}$$

10.5 #7 cont.

We reject the null, there is evidence to suggest increase in carry on luggage with 99% certainty

10.5 #9

$p_0 = 0.013$ $\hat{p} = \frac{37}{1824}$ $n = 1824$

$\hat{p} = 0.0203$

$\alpha = 0.05$

$\frac{\alpha}{2} = 0.025$ $CV = [-2.81, 2.81]$

$$z = \frac{0.0203 - 0.013}{\sqrt{\frac{0.013(1-0.013)}{n}}} = 2.752$$

Fail to reject Null hypothesis. There is no evidence to suggest a change in heroin usage at the $\alpha = 0.05$ confidence interval.

10.5 prob 11

$\hat{p} = \frac{5}{50}$ $\quad$ $p_0 = 0.02$

$\hat{p} = 0.10$ $\quad$ $\alpha = 0.01$

Has Not decreased. Fail to reject Null hypothesis at any level of significance.

$\boxed{10.5 \# 13}$

$\hat{p} = \frac{4}{100} = 0.04$ $\quad$ $n = 100$

$H_0 \rightarrow p_0 = 0.05$ $\quad$ $\alpha = 0.10$

$CV = 1.282$

$$\frac{0.04 - 0.05}{\sqrt{\frac{0.05(0.95)}{100}}} = z = -0.117$$

$p = 0.4522$

Fail to reject the null. There is not sufficient evidence at the $\alpha = 0.10$ level of significance to suggest a greater than 5% failure rate

10.5 prob 15)

$H_0 = 0.15$ $\quad n = 80$

$H_A > 0.15$ $\quad \hat{p} = \frac{13}{80} = 0.163$

$\alpha = .01$ $\quad CV = 2.326$

$$\frac{0.163 - 0.15}{\sqrt{\frac{0.15(0.85)}{80}}} = 0.326$$

There is not sufficient evidence ~~at~~ the $\alpha = 0.01$ level of significance to dererimine that there is grewer than 15% gypsum in the material.

10.5 #17

$H_0 = 0.02$ $\quad \hat{p} = \frac{3}{1400} = 0.00214$

$n = 1400$

$\alpha = 0.05$

a) $CV = 1.645$

$$\frac{0.00214 - 0.002}{\sqrt{\frac{0.002(1-0.002)}{1400}}} = 0.117$$

$H_A > H_0$

a cont) At the $\alpha = 0.05$ level of significance there is not sufficient evidence to indicate an increase in defect rate.

b) 0.4522

c) NO

---

10.5 # 19

$H_0 = 0.40$ $\qquad n = 500$ $\qquad \frac{192}{500} = 0.384$

$$\frac{.384 - 0.4}{\left(\frac{0.4(0.6)}{500}\right)^{1/2}} = -0.73$$

$p = 0.2327$

b) $\alpha = 0.05$

At the $\alpha = 0.05$ level of significance there is not sufficient data that KOPE does not have at least 40% of the market.

10.5 #21

$H_0 = 0.32$ $\qquad \hat{p} = \frac{50}{200} = 0.25$

$\alpha = 0.05$

$H_0 > H_A$

$CV = -1.645$ $\qquad Z = \dfrac{0.25 - 0.32}{\left(\dfrac{0.32(1-0.32)}{200}\right)^{\frac{1}{2}}} = -2.122$

$$\underset{Z}{-1.65} > \underset{CV}{-2.576}$$

There is sufficient evidence at the $\alpha = 0.05$ level of significance that there was a decrease in the percentage of smokers after the price increase.

---

10 #3 $\qquad n = 50 \qquad M_0 = 3.5$

$\alpha = 0.1 \rightarrow CV \approx -1.282$

$H_A < H_0 \qquad \bar{X} = 2.8$

$s = 1.14$

$$\frac{2.8 - 3.5}{\left(\frac{1.14}{\sqrt{50}}\right)} = -4.342$$

$$\underline{-4.342 < -1.282}$$

At the $\alpha = 0.1$ level of significance there is sufficient evidence that the new drug was effective in reducing relief time.

10 # 7

$\mu_0 = 895$ $\sigma = 225.00$

$\bar{x} = 915$ $n = 180$ $\alpha = 0.10$

$s = 227.50$

$CV = 1.282$

$H_A =$ $z > CV$

$$\frac{915 - 895}{\left(\frac{225}{\sqrt{180}}\right)} = 1.193 = z$$

$$1.193 \cancel{>} 1.282$$

At the $\alpha = 0.1$ level of significance there is not sufficient evidence to suggest an increase in population mean of rent.

10 #8

$\mu_0 = 10192$

$n = 25$ $\bar{x} = 9750$

$df = 24$ $s = 14000$ $\alpha = 0.05$

$H_A = (\mu_0 \neq \bar{x})$ $CV = |2.064|$

$$\frac{9750 - 10192}{\left(\frac{14000}{\sqrt{24}}\right)} = -1.579$$

$H_A \rightarrow |2.064| < |-1.579|$ Fail to reject

At the $\alpha = 0.05$ level of significance there is not sufficient evidence to determine a difference exists in the mean price of used cars at the dealership.

10 #9

$p_0 = 0.003$

$n = 6000$ $\hat{p} = \frac{12}{6000} = 0.002$

$\alpha = 0.05$ $CV = -1.645$

$$\frac{0.002 - 0.003}{\left(\frac{0.003(1-0.003)}{6000}\right)^{\frac{1}{2}}} = -1.416 = Z$$

$H_A = Z < CV$

$-1.416 < -1.645$ Fail to reject

At the $\alpha = 0.05$ level of significance there is not sufficient evidence to suggest a reduction in error rates

b) $p = 0.0778$

c) $\alpha = 0.10$ $CV = 1.282 \rightarrow 0.1003$

Yes

10 #13

$\alpha = 0.01$ CV =

a) $H_0: \mu \le 15$, $H_a: \mu > 15$, $z = 2.5$

$p = 0.0062$

$0.0062 < .01$ Reject the Null

b) $H_0: \mu \ge 80$, $H_A: \mu < 80$ $z = -1.95$

$p = 0.0256$

$\overset{p}{0.0256} \overset{>}{>} \overset{\alpha}{0.01}$ Fail to reject

c) $H_0: \mu = 1200$, $H_A: \mu \ne 1200$ $z = 3.20$

$p \approx 0$

$0 < 0.01$ Reject the Null

$p < \alpha$

10 # 19

Inversed, still works.

$p_0 = 0.1$ $\alpha = 0.1$ $CV = 1.282$

$\hat{p} = \frac{28}{350} = 0.08$

$H_A < H_0$

$$\frac{0.08 - 0.1}{\left(\frac{0.1(0.9)}{350}\right)^{1/2}} = -1.247$$

$p = 0.1056$

$0.1056 > 0.1$ Fail to reject the null.

At the $\alpha = 0.1$ level of significance there is not sufficient evidence to reject the claim that more than 90% of manufacturers do not offer child care benefits.