Classwork #19

P-value approach

step 1
Ho: \( \mu \geq 30 \) hrs
Hi: \( \mu < 30 \) hrs \( \text{Left tail} \)

step 2
Pop stand dev \( \sigma \) known
Use Z Test

step 3
Calculate test stat \( Z \)
\[
Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{27 - 30}{1.4} = -2.14
\]

p-value is shaded region

\( Z = -2.14 \)
p-value = .0162

\( \alpha = .025 \)
so \( p-value < \alpha \) so

reject Ho

Mean time spent reading by all adults is less than 30 hours. (at 0.5% signif)

b) if \( \alpha = .01 \) (and p-value = .0162 as before)

\( p-value \geq \alpha \) so
do not reject Ho

Conclude that the mean time spent reading by all adults is probably 30 hours. (at 1% signif)
Classwork #18

2. p 431 #16 b)

Step 1: $H_0: \mu = 90.25$ oz
Ht. $\mu \leq 90.25$ oz "less than" left tail

Step 2: Known use Z dist
Step 3: $\alpha = 0.025$ left tail

Reject $H_0$

$Z = -1.96$

Step 4: Calculate test stat $Z = -3.18$, as before

Step 5: Reject $H_0$ Conclude mean daily water consumption is less than 90.25 oz

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c) The type I error occurs when a true null $H_0$ is rejected

a) If we conclude mean consumption differs from 90.25 oz and actual mean consumption is 90.25 oz, we have made a type I error, $\alpha = 0.01$

b) If we conclude mean is less than 90.25 oz and mean is actually 90.25 oz, that's type I error — 2.5% chance of making that error
Classwork #18

(2) p 431 #16

Old mean $\mu = 90.25$ oz

$n = 45$

$\bar{x} = 83.15$ oz

$\sigma = 15$ oz

$\alpha = 0.01$ Critical value approach

Step 1: $H_0: \mu = 90.25$ oz

$H_1: \mu \neq 90.25$ oz "differs" two-tail

Step 2: $\sigma$ Known, use $z$ dist

Step 3:

\[ \frac{0.01}{\sqrt{2}} = 0.005 \]

\[ z = -2.58 \quad z = 2.58 \]

Step 4:

\[ \sigma_x = \frac{\sigma}{\sqrt{n}} = \frac{15}{\sqrt{45}} = 2.23606798 \text{ oz} \]

\[ z = \frac{\bar{x} - \mu}{\sigma_x} = \frac{83.15 - 90.25}{2.23606798} = -3.18 \]

Step 5: Test stat $z = -3.18$ is in reject region

Reject $H_0$.

Conclude mean daily water consumption differs from 90.25 oz (at 1% signt.)
Classwork #18

2. p 431 #16

d) Test Stat $z = -3.18$

Look up, get area = 0.0007

Two-tailed test, so

$p$-value = 2($0.0007$) = $0.0014$

If $\alpha = 0.01$

$x > p$-value

0.01 > 0.0014  Reject $H_0$

e) Test Stat $z = -3.18$

Look up, get area = 0.0007

Left-tailed test, so

$p$-value = 0.0007

If $\alpha = 0.025$

$x > p$-value

0.025 > 0.0007

Reject $H_0$