CIMT Statistics p180 Ex9A

1. let X = IQ score

$X \sim N(\mu, 15^2)$

sample of 10 has mean of 110.

H_0: sample is typical, $\mu = 100$
H_1: sample is not typical, $\mu \neq 100$

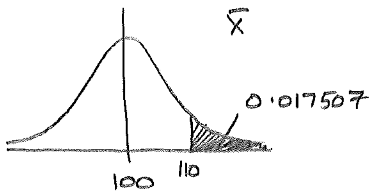
Assume H_0 to be true

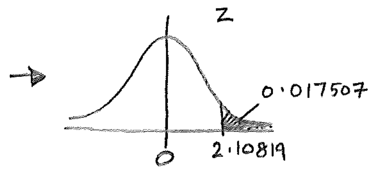
$\alpha = 5\%$

two tail test

$\bar{X}$ = mean of sample of size 10

$\bar{X} \sim N\left(100, \frac{15^2}{10}\right)$





$P(\bar{X} > 110) = P\left(Z > \frac{110 - 100}{\sqrt{\frac{15^2}{10}}}\right)$

$= P(Z > 2{\cdot}10819)$

$= 0{\cdot}017507$ from normCdf (2·10819, 9E99)

p-value $= 2 \times P(\bar{X} > 110)$

$= 2 \times 0{\cdot}017507$

$= 0{\cdot}035015$

$< 0{\cdot}05$

Hence, we reject H_0 and conclude that the mean IQ score is not 100, and so the sample of 10 is not typical of the general population.

2. large group has mean 75 bpm with st. dev 12 bpm

sample of 30 has mean 82 bpm

H_0: sample has mean 75 bpm $(\mu = 75)$

H_1: sample has higher mean $(\mu > 75)$

Assume H_0 to be true

$\alpha = 5\%$, one tail test

let X = pulse rate

$E(X) = 75 \quad Var(X) = 12^2$

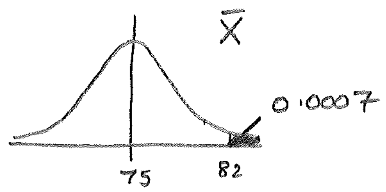
let $\bar{X}$ = mean pulse from sample of size 30

by CLT, $\bar{X} \approx N\left(75, \frac{12^2}{30}\right)$

$$P(\bar{X} > 82) = P\left(Z > \frac{82-75}{\sqrt{\frac{12^2}{30}}}\right)$$

$$= P(Z > 3.19505)$$

$$\approx 0.000699$$



$$p\text{-value} = P(\bar{X} > 82)$$

$$= 0.0007$$

$$< 0.05$$

so we have evidence to reject H_0 and so the mean bpm is greater than 75, and so the class of 30 students is not typical of the large group of female students. Maybe the 30 students are not all girls?

3.

shrimps have mean length 39mm with st. dev = 5.3mm

sample of size 10 has mean length of 41mm

H_0 : shrimps have same length as before, ie. $\mu = 39$

H_1 : shimps have grown, ie. $\mu > 39$

Assume H_0 to be true

$\alpha = 5\%$

one tail test

X = length of shimp.

$E(X) = 39$

$Var(X) = 5.3^2$

let $\bar{X}$ = mean length of 10 shimp

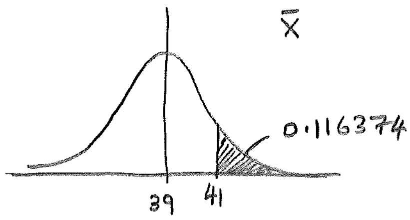
sample size too small to implement CLT

<u>if</u> we assume X is distributed normally, then $\bar{X} \sim N\left(39, \frac{5.3^2}{10}\right)$

$$P(\bar{X} > 41) = P\left(Z > \frac{41-39}{\sqrt{\frac{5.3^2}{10}}}\right)$$

$$= P(Z > 1.19331)$$

$$\approx 0.116374$$



So p-value $= P(\bar{X} > 41)$

$= 0.116374$

> 0.05

so we don't reject H_0 and conclude that we have evidence that the mean length of shrimps has not changed.