Homework №13

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18.2 (a) From the Table A, we get that $z_{\alpha/2} = 1.96$. Therefore, the confidence interval is from

$$\overline{x} - 1.96 \times \frac{\sigma}{\sqrt{n}} \text{ to } \overline{x} + 1.96 \times \frac{\sigma}{\sqrt{n}} \text{ which is from 1.799 to 2.040.}$$

(b) As the sample size is large (30 or more), the central limit theorem or CLT promises us that the sampling distribution of the sample mean is approximately normal.

(c) The reasons are selection and non-response bias.
Selection bias as only the completed calls were present in the sample and non-response bias bias as only 5029 calls from 45956 possible calls were completed.

18.6 (a) Margin of Error $= 1.96 \times \frac{7.5}{\sqrt{100}} = 1.47$.

(b) Margin of Error (400 young men) $= 1.96 \times \frac{7.5}{\sqrt{400}} = 0.735$.

Margin of Error (1600 young women) $= 1.96 \times \frac{7.5}{\sqrt{1600}} = 0.3675$.

(c) From the formula, it is easy to see that as sample size n increases, the Margin of Error decreases.

18.8 (a) **<u>State the hypothesis</u>**

$H_0 : \mu = 514$ or $H_a : \mu > 514$

<u>Compute test statistic</u>

$$z = \frac{\overline{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{541 - 514}{\frac{118}{\sqrt{50}}} \approx 1.62$$

Find the P-value

$P = P(z > 1.62) = P(z < -1.62) = 0.0526$

State the conclusion

Since $P > \alpha$, the null hyopthesis is accepted and the result is not statistically significant

(b) **State the hypothesis**

$H_0 : \mu = 514$ or $H_a : \mu > 514$

Compute test statistic

$$z = \frac{\overline{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{542 - 514}{\frac{118}{\sqrt{50}}} \approx 1.68$$

Find the P-value

$P = P(z > 1.68) = P(z < -1.68) = 0.0465$

State the conclusion

Since $P < \alpha$, the null hyopthesis is rejected and the result is statistically significant

18.9 (a) For $n = 9$, $z = \dfrac{4.8 - 5.0}{\frac{0.6}{\sqrt{9}}} = -1$ and $P = P(z < -1) = 0.1587$

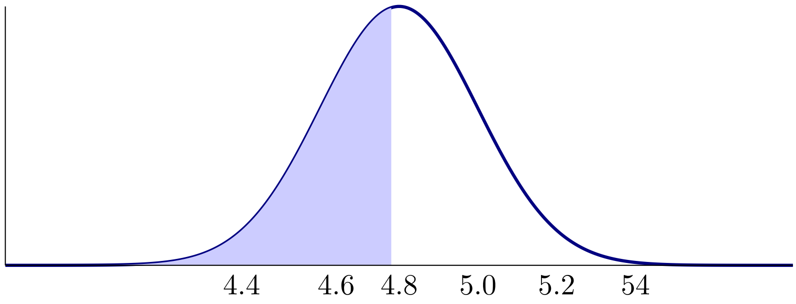
For $n = 9$, $z = \dfrac{4.8 - 5.0}{\frac{0.6}{\sqrt{16}}} = -1.33$ and $P = P(z < -1.33) = 0.0918$

For $n = 9$, $z = \dfrac{4.8 - 5.0}{\frac{0.6}{\sqrt{36}}} = -2$ and $P = P(z < -2) = 0.0228$

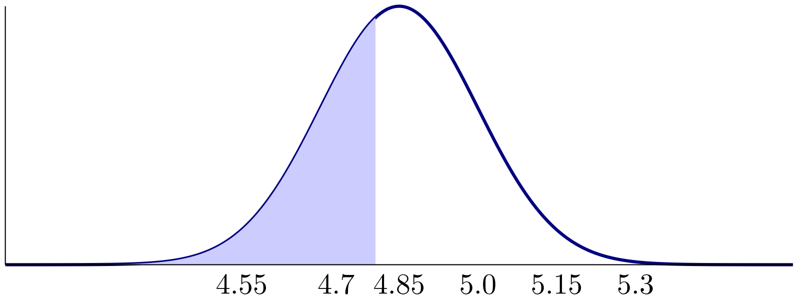
For $n = 64$, $z = \dfrac{4.8 - 5.0}{\frac{0.6}{\sqrt{36}}} = -2.67$ and $P = P(z < -2.67) = 0.0038$

And obviously, we observe that as the sample size increases, the P-value decreases.

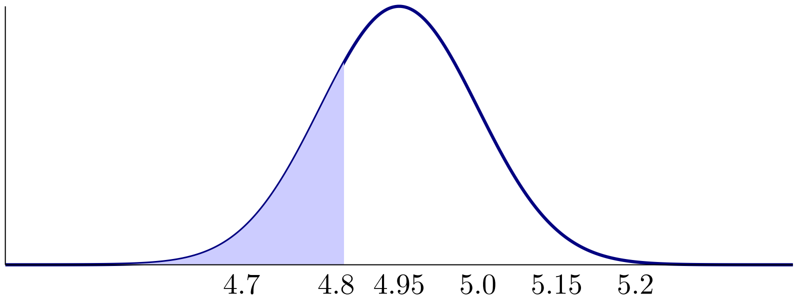
(b) For $n = 9$



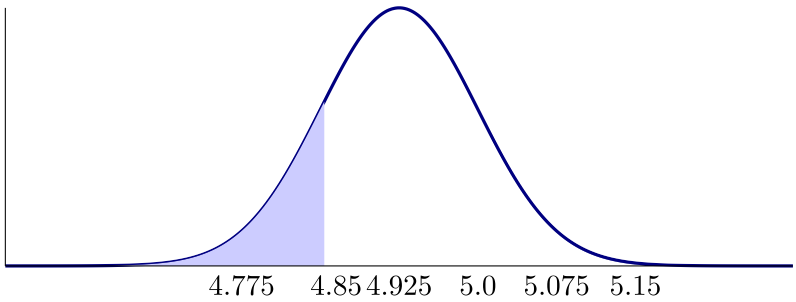
For $n = 16$



For $n = 36$



For $n = 64$



18.10 The confidence interval is from $4.8 - 1.96 \times \dfrac{0.6}{\sqrt{n}}$ to $4.8 + 1.96 \times \dfrac{0.6}{\sqrt{n}}$.

Thus, we have:

For n = 9, we have the confidence interval from 4.408 to 5.192.
For n = 16, we have the confidence interval from 4.506 to 5.094.
For n = 16, we have the confidence interval from 4.604 to 4.996.
For n = 16, we have the confidence interval from 4.653 to 4.947.

18.12 Let's use the formula for the sample size which is $n = \left(\dfrac{z_{\alpha/2} \times \sigma}{E}\right)^2$.

We get that $n = \left(\dfrac{1.96 \times 7.5}{1}\right)^2 \approx 217$.

18.13 Let's use the formula for the sample size which is $n = \left(\dfrac{z_{\alpha/2} \times \sigma}{E}\right)^2$.

We get that $n = \left(\dfrac{1.645 \times 125}{10}\right)^2 \approx 423$.

18.33 The effect of the outlier is obviously greater when the sample size is small. With large sample sizes, the effect of the outlier is relatively low.

18.36 (a) Test of significance does not answer this question. The researchers determine whether the design is proper or not.

(b) Test of significance answers this question. A significance test takes into consideration the sampling error, which is indeed the observed effect due to chance.

(c) Test of significance does not answer this question. The researchers determine whether the observed effect is important or not.