Summary.

estimation for mean: $\mu$.

point estimator $= \bar{X}$

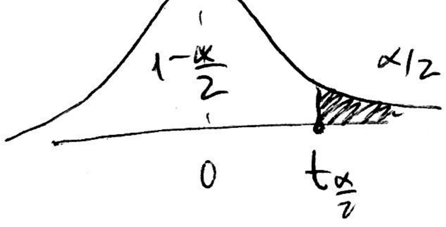
interval estimator: point estimator $- E <$ parameter $<$ point estimator $+ E$

$$E = t_{\frac{\alpha}{2}} \frac{S}{\sqrt{n}}, \quad S = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2}.$$

S: standard deviation from the sample

n: sample size.

$t_{\frac{\alpha}{2}}$: critical value from a student t distribution that separates an upper $\alpha/2$ area from a lower $1-\alpha/2$ area, with $(n-1)$ degrees of freedom. $(df = n-1)$.



$df = n-1$

an interval estimator for $\mu$ is

$$\bar{X} - t_{\frac{\alpha}{2}} \frac{S}{\sqrt{n}} < \mu < \bar{X} + t_{\frac{\alpha}{2}} \frac{S}{\sqrt{n}}.$$

sample size: E, confidence $(1-\alpha)100\%$.

$$n = \left(\frac{z_{\alpha/2}\,\sigma}{E}\right)^2$$

if $\sigma$ (population) is known, just plug it into the formu

if $\sigma$ is unknown: $\frac{\text{range}}{4}$ ; S ; $\sigma$ from a previous study.

step 7.

- because $z^{stat} = 3.21$ is greater than critical value $z_\alpha = z_{0.05} = 1.645$, we reject the null hypothesis.
- because the p-value $= 0.0007$ is smaller than the level of significance $\alpha = 0.05$, we reject the null hypothesis.

step 8.

(condition 1: claim does not include equality and we reject $H_0$).

There is enough evidence to support the claim that the proportion of girls born to parents using the XSORT method of gender selection is greater than 0.5.

There is enough evidence to support the claim that the XSORT method of gender selection is effective and it increases the chances of having a girl.

# Slide 9.

claim: the proportion of girls born to parents using the XSORT method of gender selection is greater than 0.5.

step 1: $p > 0.5$
step 2: $p \le 0.5$
step 3: $H_0: p = 0.5$  $H_1: p > 0.5$
step 4: $\alpha = 0.05$
step 5: $z^{stat} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$ assuming that Ho is true

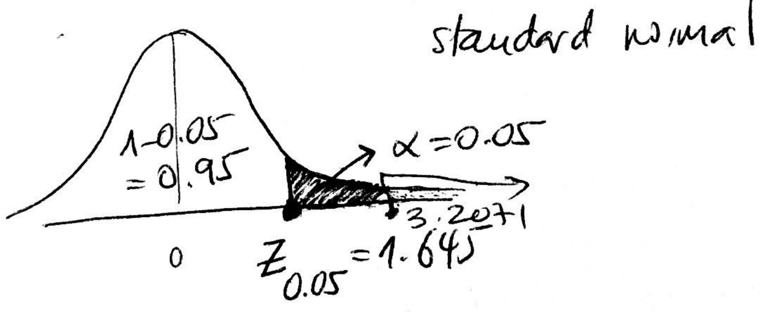
it follows the standard normal distribution.

check: $\left.\begin{matrix} np \geq 5 \\ n(1-p) \geq 5 \end{matrix}\right\}$ assuming that Ho is true.

$n = 14$ : $np = 14 \cdot 0.5 = 7 \geq 5$
$n(1-p) = 14 \cdot (1 - 0.5) = 14 \cdot 0.5 = 7. \geq 5.$

$$z^{stat} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} \Rightarrow \frac{\overset{0.93}{\frac{13}{14}} - 0.5}{\sqrt{\frac{0.5(1-0.5)}{14}}} = 3.2071.$$

step 6:
plot critical region.



the critical value is $z_{0.05} = 1.645$.

has the standard normal distr.

$$\text{p-value} = P(X > 3.2071 \mid \text{null hypothesis is true}) = P(X > 3.2071)$$
$$= 1 - P(X \leq 3.2071) = 1 - 0.9993 = 0.0007$$

Slide 12

step 1: "fewer than $\overset{0.3}{30\%}$ of adults have sleepwalked".

symbols: $p < 0.3$.

step 2: $p \geq 0.3$.

step 3: $H_0 : p = 0.3$   $H_1 : p < 0.3$

step 4: $\alpha = 0.05$.

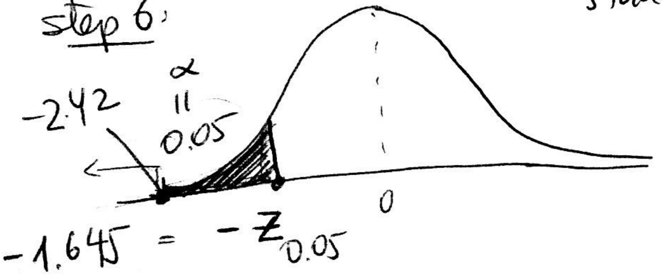
step 5: $z^{stat} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} = \frac{0.292 - 0.3}{\sqrt{\frac{0.3(1-0.3)}{19136}}} = -2.42.$

$n \cdot p = 19136 \cdot 0.3 = 5740.8 \geq 5$

$n(1-p) = 19136(1-0.3) = 13395.2 \geq 5.$

step 6:

standard normal



the critical value is -1.645

the critical region is all the $z^{stat} < -1.645$

p-value $= P(\underset{\uparrow}{X} < -2.42) = 0.0078.$

has standard normal.

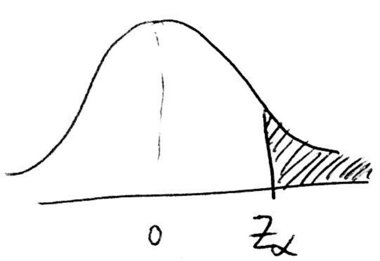
step 7: we reject the null hypothesis.

- because $z^{stat} = -2.42$ is smaller than the critical value $-1.645$
- because the p-value $0.0078$ is smaller than the level of significance $\alpha = 0.05$.

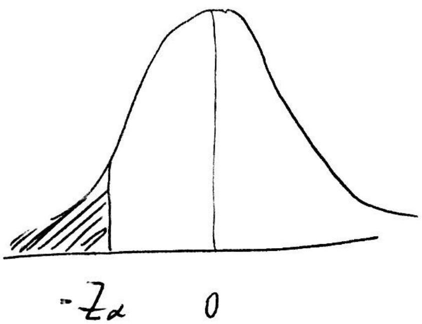
step 8: There is enough evidence to support the claim fewer than 30% of adults have sleepwalked.

possible rejection regions

$H_1 : p > 0.2$



$H_1 : p < 0.2$



$H_1 : p \neq 0.2$