this time: statistical inference for means & proportions
next time:

read: DD(B) ch 11; LN pp L-137 → L-160

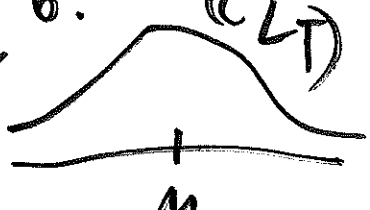
AMS 7
6 Nov 18

1

intertidal crabs
L-138

on the basis of this dataset, we think that μ is around 25.0°C ($\bar{y}$), give or take about 0.27°C ($\widehat{SE}(\bar{y})$), and a 95% CI for μ runs from 24.52 to 25.6°C

$\widehat{SE}$ 0.27°C (CLT)

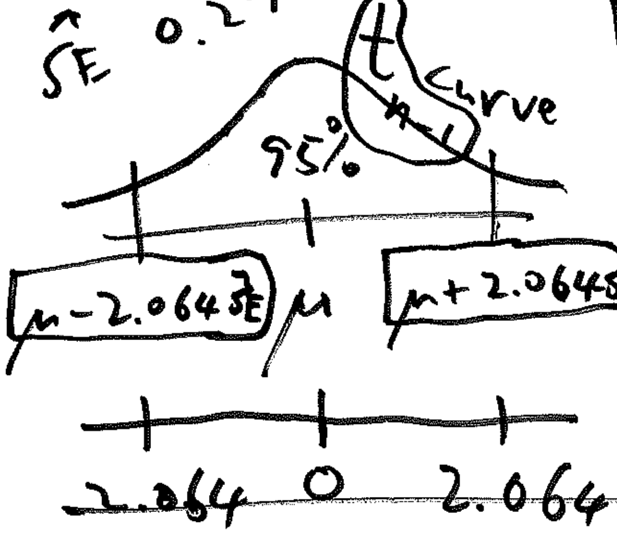


μ

long run hist of $\bar{y}_n$

L-124

W. S. Gosset (1908)



(n obs)

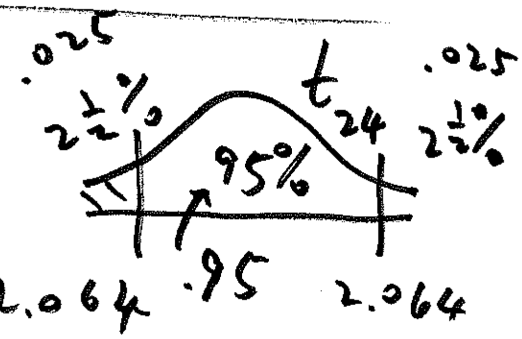
long run hist of $\bar{y}$, accounting for uncertainty in σ

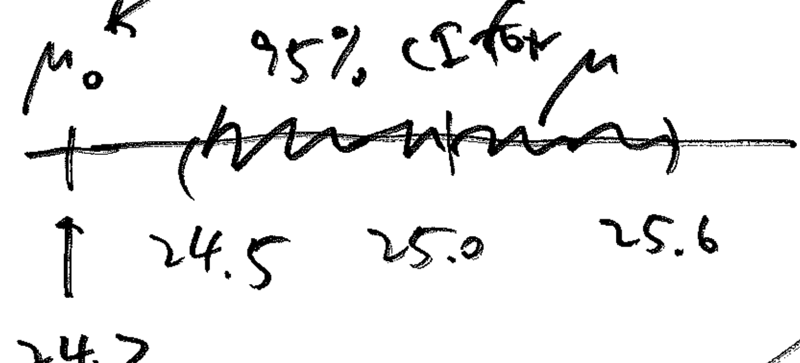
t_{n-1} = t curve with n degrees of freedom

$n = 25$

t_{24}

L-142 t table





informally we're pretty sure that μ is somewhere between 24.5 & 25.6

$$0.95 = P\left(\boxed{\mu - 2.064\,\hat{SE} < \boxed{\bar{Y}} < \mu + 2.064\,\hat{SE}}\right) =$$ ③

$=$ (**)

* Neyman's confidence trick

$$\mu < \cancel{2.064\,SE}\ \bar{Y} + 2.064\,\hat{SE}$$

$$\bar{Y} - 2.064\,\hat{SE} < \mu$$

(**) $P\left(\underline{\bar{Y} - 2.064\,\hat{SE}} < \mu < \underline{\bar{Y} + 2.064\,\hat{SE}}\right)$

$= 0.95 = 95\% \longrightarrow$

$\bar{Y} \pm 2.064\,\hat{SE}(\bar{Y})$ is a 95%

<u>confidence interval</u> (CI) for μ

$$25.0^\circ C \pm 2.064\,(0.27^\circ C) = (24.4,\ 25.6)^\circ C$$

12.45

Since theory value $\mu_0 = 24.3$ for μ is not in the 95% CI for μ, ① we conclude that the theory is probably wrong

② the difference between 24.3 & 25.0 is statistically significant (statsig) at the 95% level of confidence

completely different question: is the diff. between 24.3 & 25.0 practically significant (practsig)?

difference between theory value μ_0 & data value $\bar{Y}$ stat. sig $\leftrightarrow$ difference is hard to attribute to unlucky random sampling $\leftrightarrow$ theory probably wrong

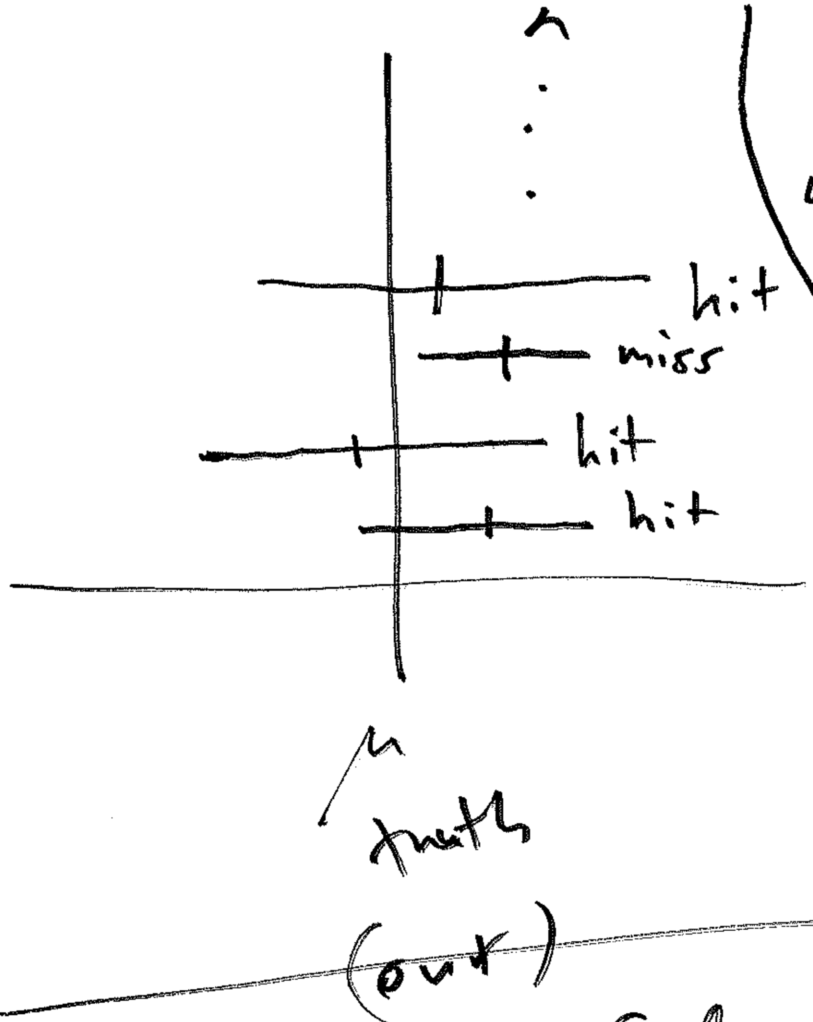
---

is confidence = probability?

95% CI for μ is $(24.5, 25.6)$; does this mean that

$$P_{F}(24.5 < \mu < 25.6) = 95\% \ ?$$

frequentist — No — μ is a fixed unknown number that is either in or out of CI



Neyman guarantees about 95% of these intervals will be hits

Neyman's confidence is in the process through which our CI was made, not in the outcome of whether any one CI is a hit or a miss