this time: inference for p | read: LN pp. L-161 → L-185 | Ashley Tai
next time: hypothesis testing | today: LN pp. L-157 → | AMS 7, 10 May 18

- when $\mu_0$ is not in ___ interval,
  - 95%; diff. between theory ($\mu_0$) & data ($\bar{y}$) is statistically significant (statsig)
  - 99%; diff. is highly statsig
- completely diff. question:
  - is diff. between $\mu_0$ & $\bar{y}$ practically significant (practsig)?

We should ask:

① Practsig?
- if the diff. is too small, then stop here... otherwise,

② statsig?

Q: Is a diff. that's statsig real?

A: Opposite of real → not real
- easy to attribute to unlucky random sampling

Devil's Advocate: don't quickly assume that the theory is wrong because the diff. is statsig
↳ $\mu_0$ really is 24.3; the reason why the data ($\bar{y}$) is so different is b/c the sample size is so small & may be affected by unlucky random sampling

* always take Devil's Advocate's POV seriously (logical possibility)

* Statistics = BS filter

* Statsig (real) = hard to attribute to unlucky sampling

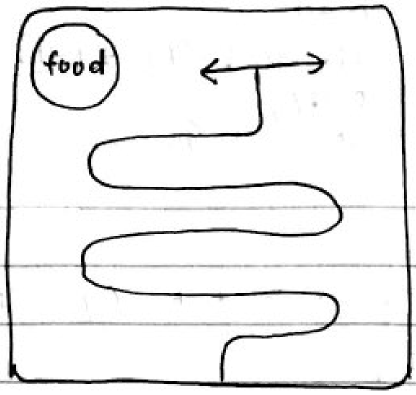
Q: Does confidence = probability?

$P_f(24.5°c < \mu < 25.6°c) = 95\%$?

A: In relative frequency version of probability — no; $\mu$ is a fixed unknown constant that doesn't change across repetitions.

Q: Okie then, what does the interval actually mean?

A: Across many repetitions of the whole process of getting random samples & building CIs, about 95% of these intervals should correctly include $\mu_0$.




## Lab rats

10 out of 12 rats turned left toward food

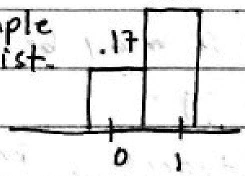
↳ 83% → practsig
→ calculate to determine if statsig

**Devil's Advocate:** You're supposed to get 50%, but got 83% instead due to unlucky random sampling.

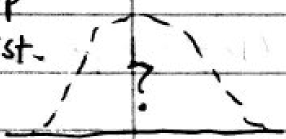
1 = L
0 = R

| pop. | | sample | | imaginary data |
|---|---|---|---|---|
| all relevant lab rats | | the observed rats | | all possible $\hat{p}$ values |
| left? | | left? | | 83%, 75%, ⋮ |
| N = ? (big) | actual like SRS (IID) → | n = 12 | | M = ∞ |
| * mean $\mu = p = ?$ | | * mean $\bar{y} = \hat{p} = \frac{10}{12}$ = .83 = 83% | | EV of $\hat{p} = p$ |
| SD $\sigma = ?$ | | | | * $\hat{SE}$ of $\hat{p} \doteq 11\%$ |
| * $= \sqrt{p(1-p)}$ | | | | |

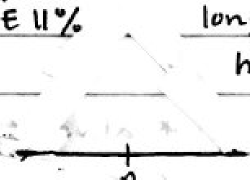
sample hist.




pop hist.




$\hat{SE}$ 11% long run hist.



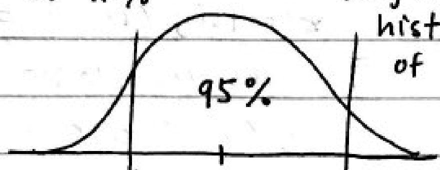

hyp IID

n = 12

mean $\hat{p}$ = ?

ex. 75%

$\hat{SE}$ 11% long run hist. of $\hat{p}$




★ = inferential summary

σ (in disguise) ↳ $\boxed{SE_{IID}(\hat{p}) = \sqrt{\frac{p(1-p)}{\sqrt{n}}}}$ $= \sqrt{\frac{(0.83)(0.17)}{12}} = 0.108 \doteq 11\%$

* don't agree w/ devil's advocate; diff. is statsig

- large-sample approximation: pretend n is large enough to use CLT

$\boxed{95\% \text{ CI for } p}$: $\hat{p} \pm 1.96\,\hat{SE}(\hat{p}) = \boxed{\hat{p} \pm 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}}$

83% ± 1.96 (11%)