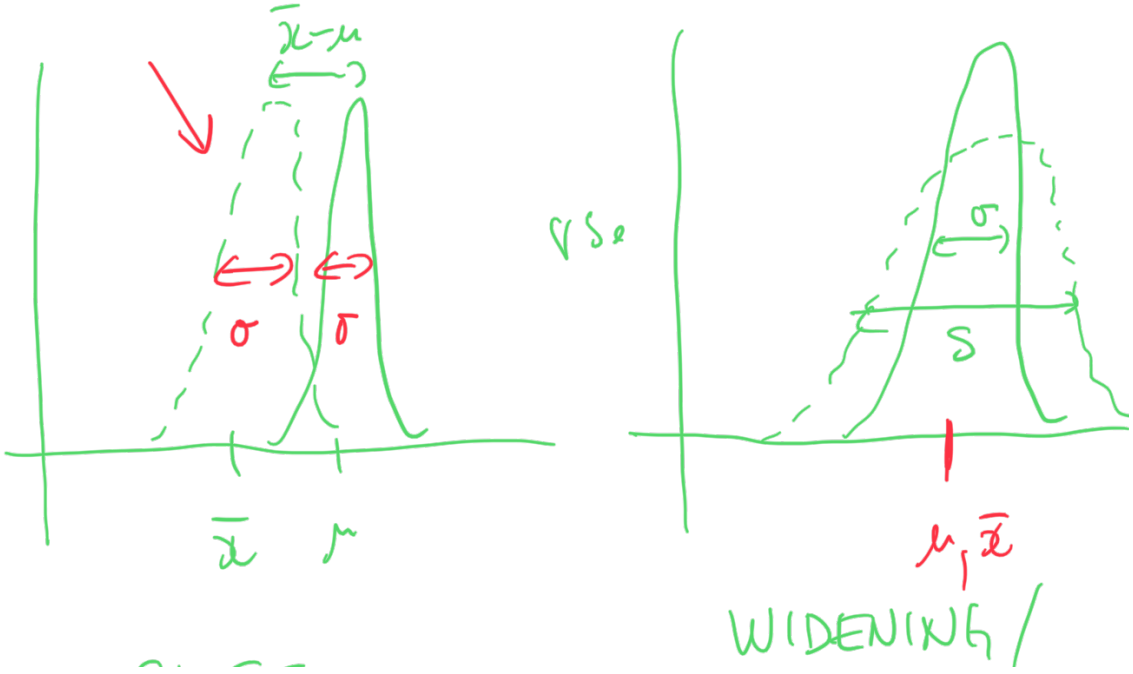
Physics 341 = Lecture 15

$z \rightarrow \bar{x}$ vs. μ (known σ)

$t \rightarrow \bar{x}$ vs. μ (unknown σ

How do we ~~test~~ if s is consistent with σ?



SHIFT

NARROWING

Define: χ^2-test

$$\chi^2 \equiv (N-1)\frac{S^2}{\sigma^2} = \nu \frac{S^2}{\sigma^2}$$

+ve, +ve, $=1$, DOF

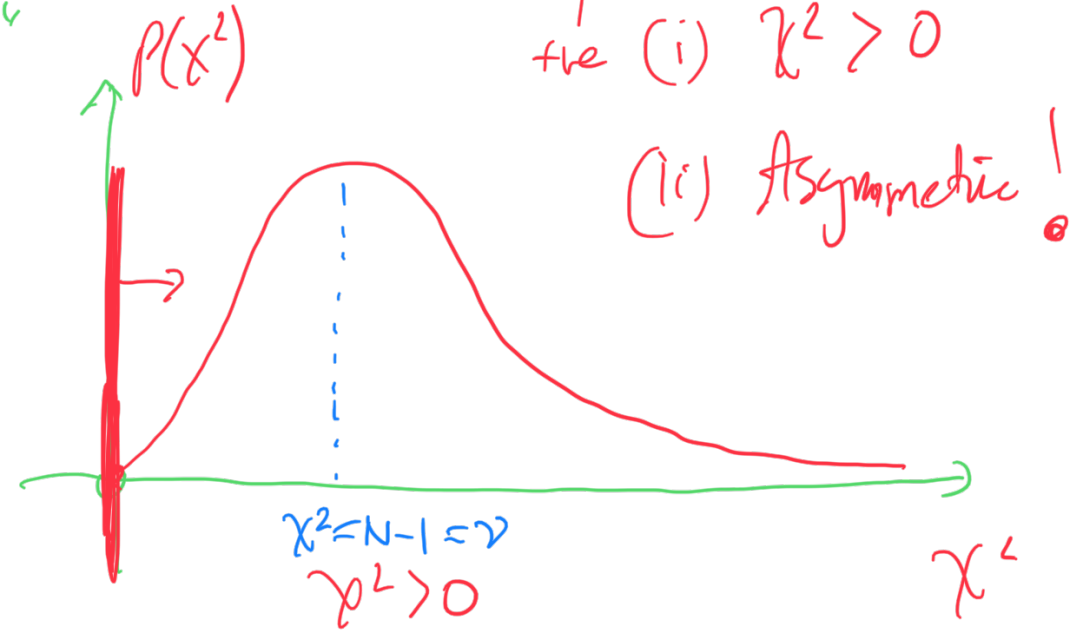
+ve (i) $\chi^2 > 0$

(ii) Asymmetric!

"perfect world"

$\bar{x} = \mu$

$S = \sigma$

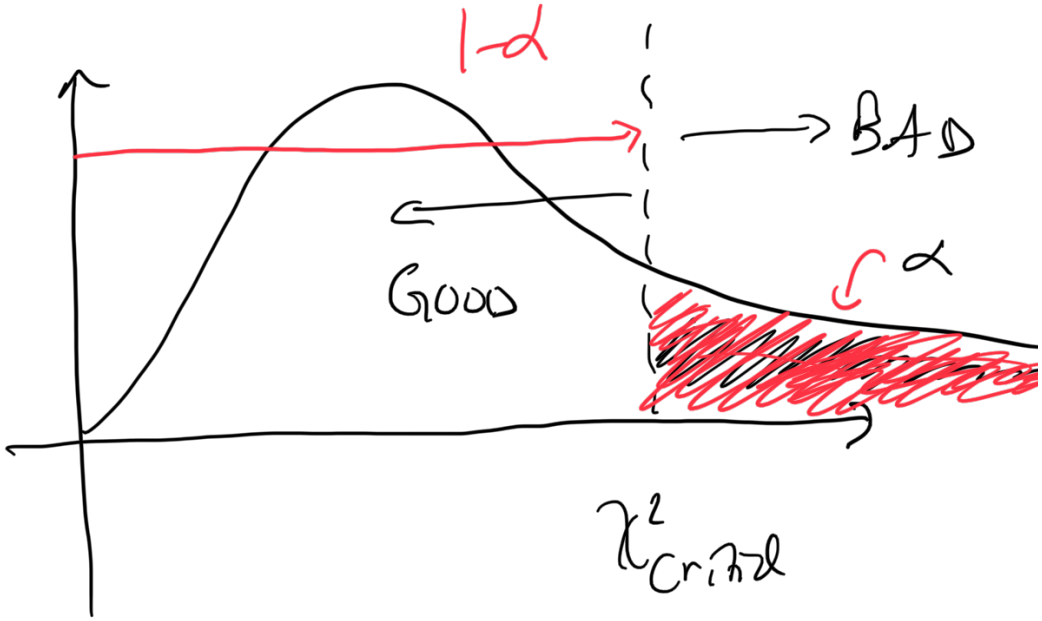


(1) $S < \sigma$?

"<" vs ">" vs "="

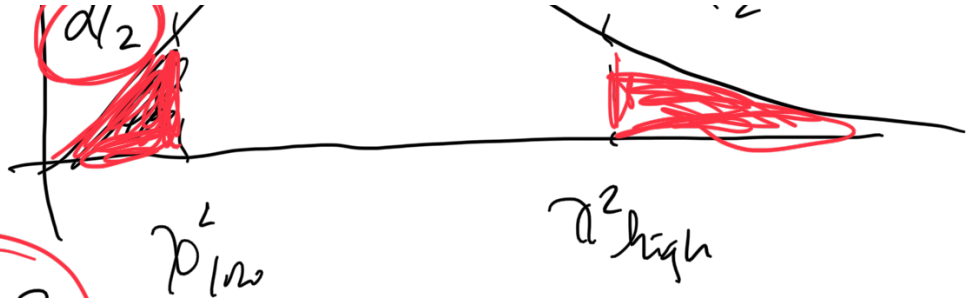
$$\chi^2_{crit,2d} = stats.chi2.ppf(\alpha,$$

② $S > \sigma$? (typical)



$$\chi^2_{crit,2d} = stats.chi2.ppf(1-\alpha,$$

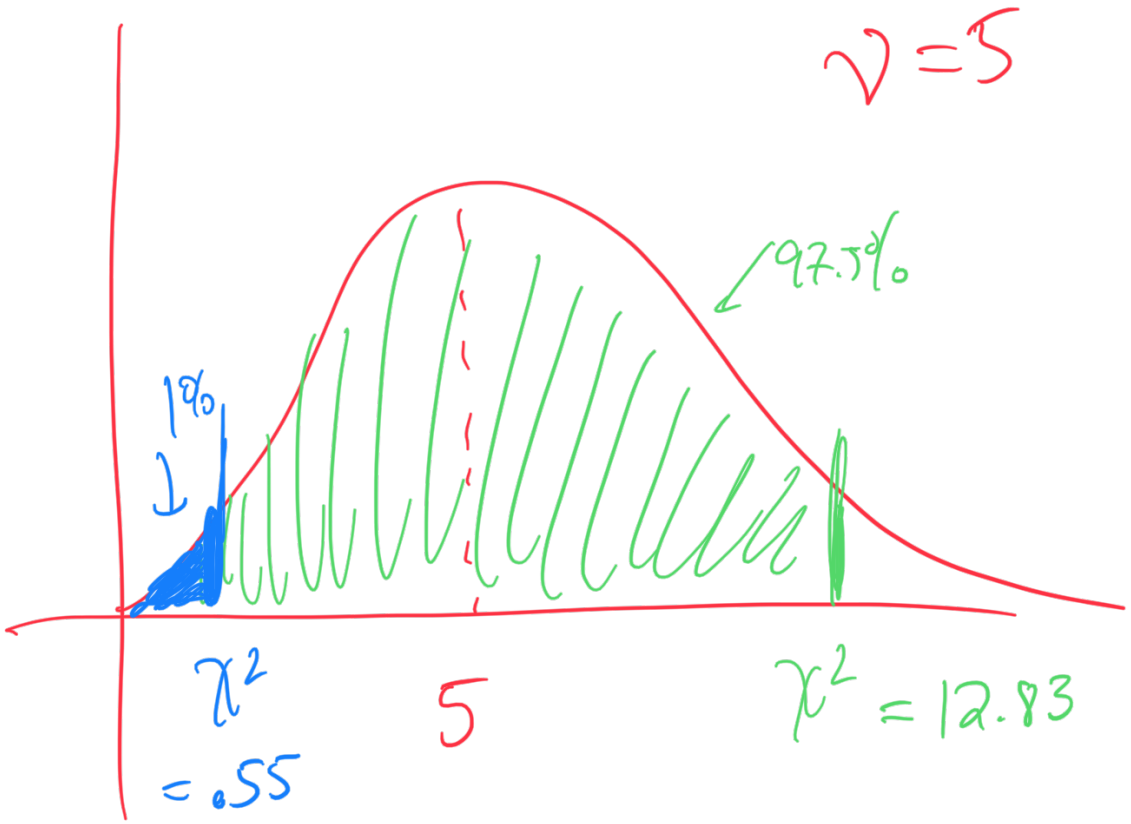
③

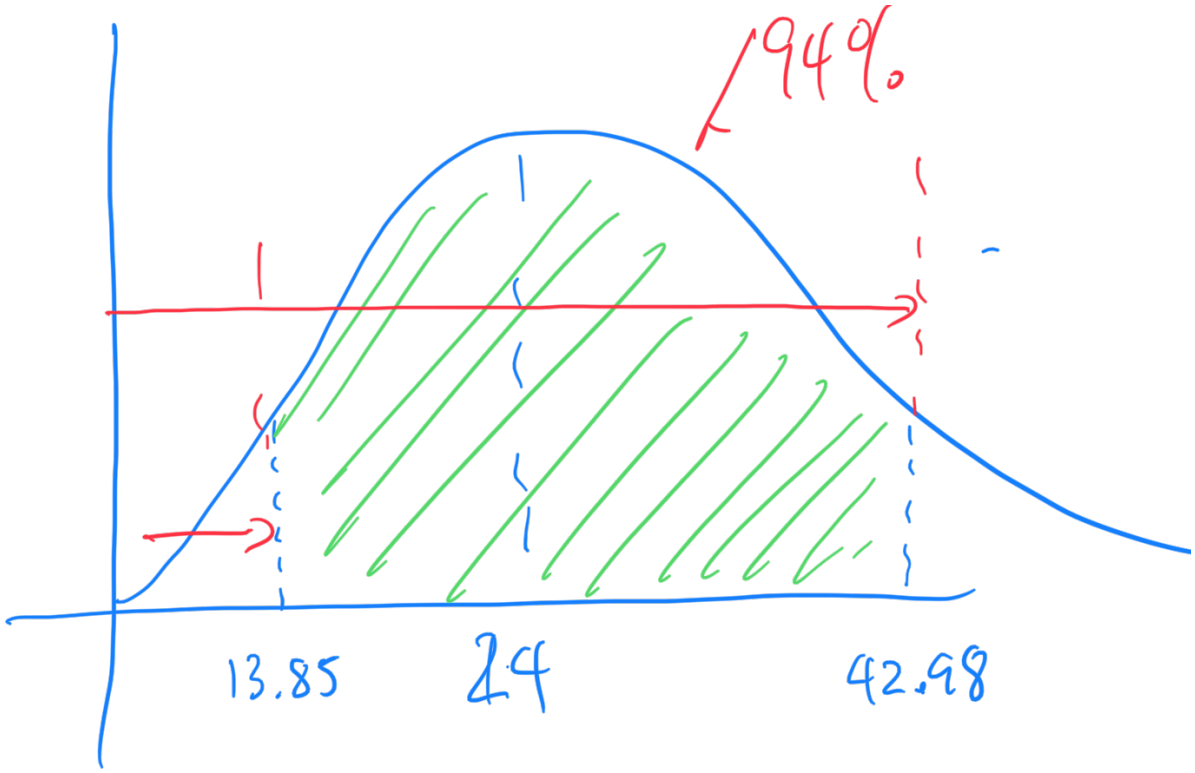


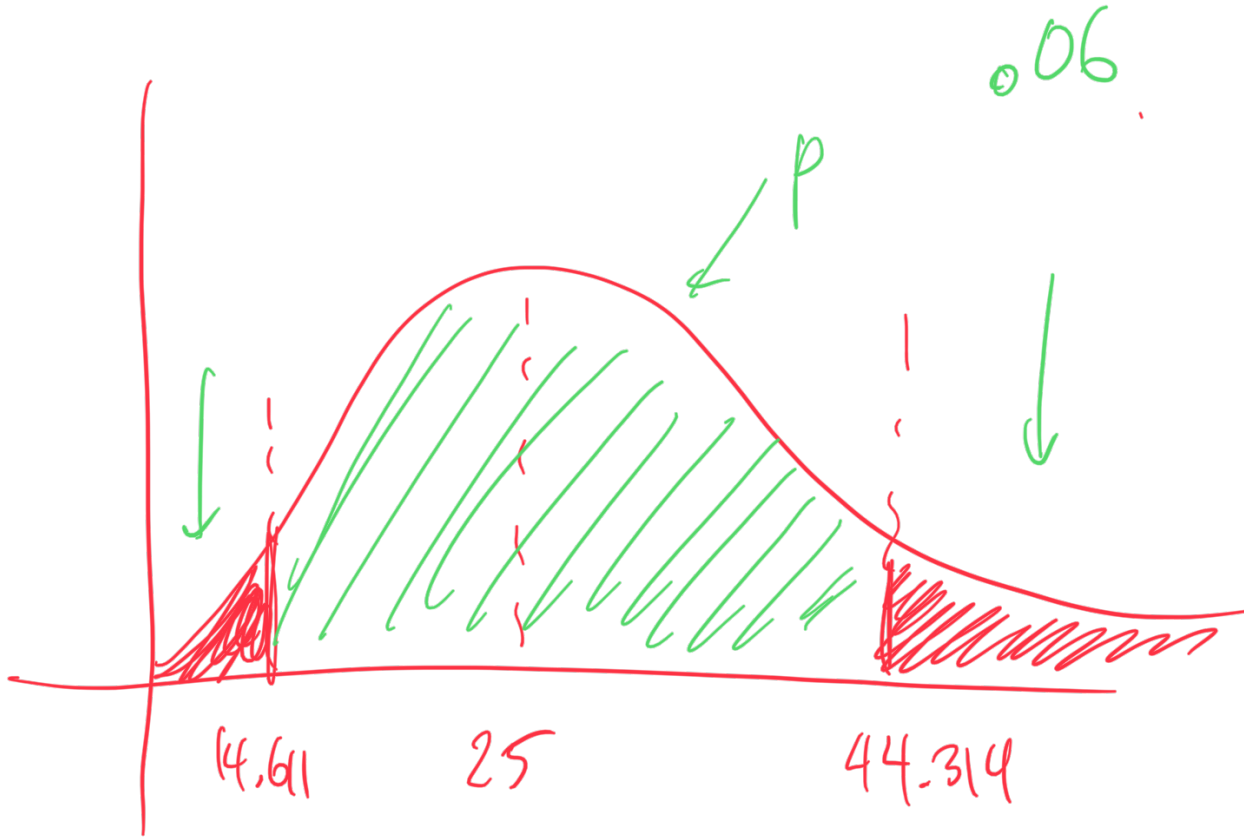
$S = \sigma$?

$$\chi^2_{low} = stats.chi2.ppf\left(\frac{\alpha}{2}, \nu\right)$$

$$\chi^2_{high} = stats.chi2.ppf\left(1-\frac{\alpha}{2}, \nu\right.$$




94%
13.85
24
42.98


.06
P
14.61
25
44.314
1 - P

8: $n = 9 \quad s = 2.86$

95% CI for σ^2 and σ

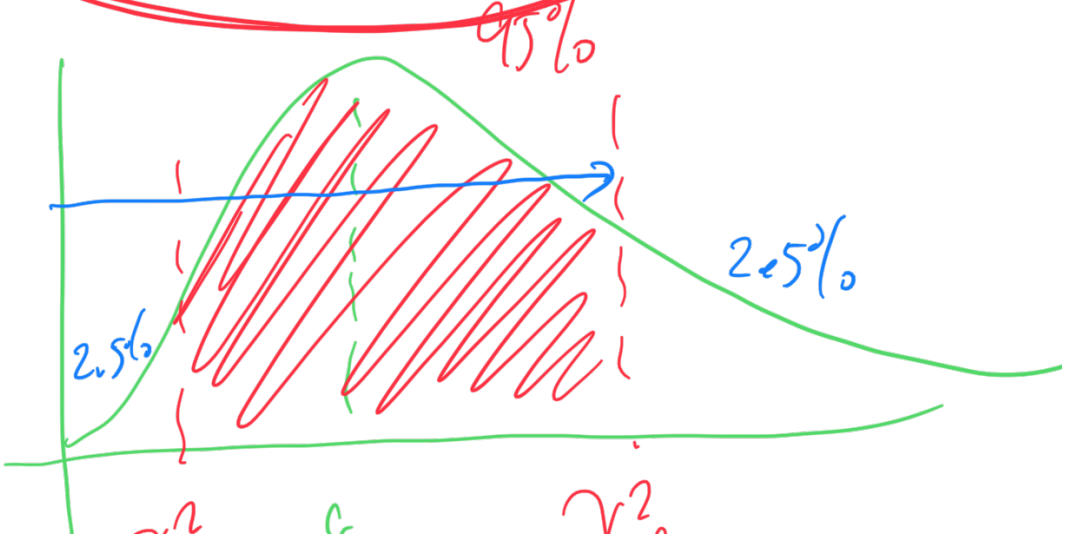
$$\chi^2 = \frac{(n-1)s^2}{\sigma^2}$$

$$\sigma^2 = \frac{(n-1)s^2}{\chi^2}$$

$n = 9$

$\nu = n - 1$

$= 8$



χ^2_{low} χ^2_{high}.

C_interval = stats.chi2.interval(.95,

= $(\chi^2_{low}, \chi^2_{high})$

χ^2_{high} = stats.chi2.ppf(.975, 8

χ^2_{low} = stats.chi2.ppf(.025, 8

$$\sigma^2_{high} = \frac{(n-1)s^2}{\chi^2_{low}}$$

σ^2_{low} $(n-1)s^2$

$$\sigma^2_{low} = \frac{\quad}{\chi^2_{high}}$$

$$\sigma_{high} = \sqrt{\sigma^2_{high}}$$

$$\sigma_{low} = \sqrt{\sigma^2_{low}}$$

$$n = 9, \quad s = 2.86$$

95% confident that

$$1.93 < \sigma < 5.48$$

Q. Real Data :

$(n, s, \bar{x})$

$$S = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2}$$

b. $\sigma = 100$ ← known

↑

Z distribution

a) $n = 25$

$\bar{x} = 8312$

→ CI on μ

$$SEM = \frac{\sigma}{\sqrt{n}}$$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$\mu = \bar{x} - z\left(\frac{\sigma}{\sqrt{n}}\right)$$

SEM

$\bar{x}$: 83.2

z: z_{high}, z_{low} → 1.64, −1.64

Midterm.

Wednesday, October 7th, 2020

9:00 am → 11:59 pm

Lab Assign → Midterm Test 1

Difference → 5 attempts per question part.

2. (a) 5 13.5

(b) 5 

(c) 5 

3-4 questions.

Not tired.

hw → mechanics of distributions ✓

"real life" examples.

Coverage

① error propagation

$$\delta g = \left(\frac{\partial g}{\partial h}\right)\delta h + \left(\frac{\partial g}{\partial t}\right)\delta t$$

(1)

Assignment 1

Assignment 2

Assignment 3

Q1-6

Not today!!

② probability distributions

(2) binomial / poisson questions.

(3) z-test / t-test

(3) (4)

- means testing

is $\bar{x} = ? > < \mu$

4 topics $\longleftrightarrow$ 4 questions