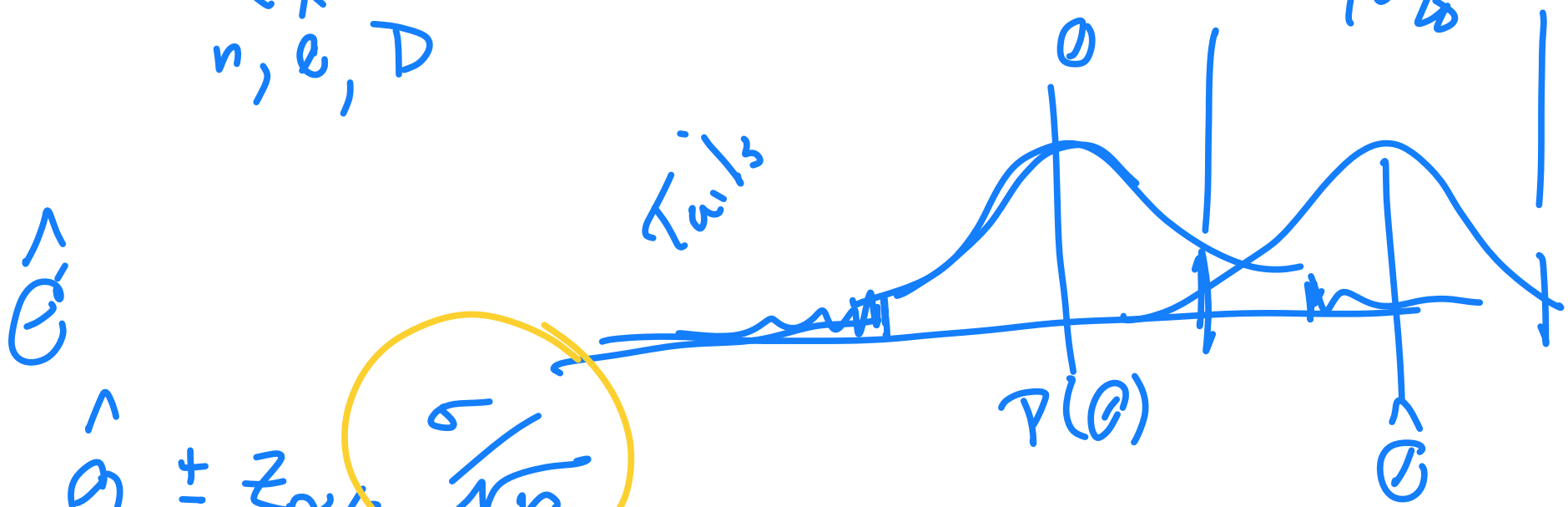
Confidence Intervals.

$$Pr(L_n \le \theta \le U_n) \le 1-\alpha$$

L_n ← $n, \hat{\theta}, D$

U_n →

$1-\alpha$ 95%



Where do we get σ^2?

S_n^2

$$T_n = \frac{\bar{X}_n - \mu}{S_n/\sqrt{n}}$$

similar.

"degrees of freedom" n

T_n is no longer standard normal.

W. G. ← Guinness.

t-distribution "student-t-distribution"

R. F.

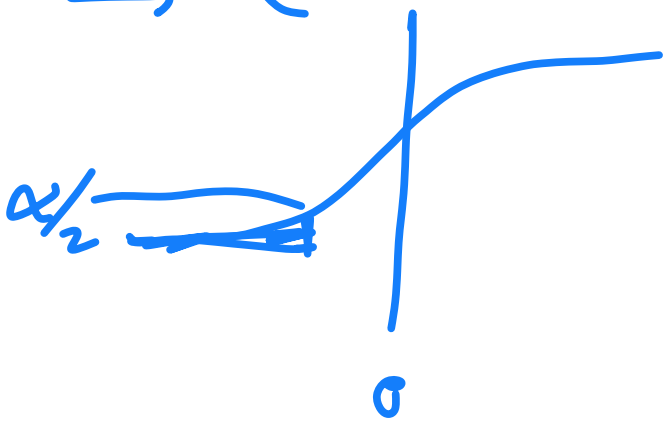
1. Get samples. $X_1 \cdots X_n$

2. Compute sample mean $\bar{X}_n$

3. Compute " " variance S_n^2

4. Decide confidence $\rightarrow \alpha$

5. Look up $t_{\alpha/2}$



$$L_n = \bar{X}_n - t_{\alpha/2} \frac{S_n}{\sqrt{n}}$$

$$U_n = \bar{X}_n + t_{\alpha/2} \frac{S_n}{\sqrt{n}}$$

Hypothesis Testing

R. Fisher - tea tasting

Null hypothesis - result you would accept w/out data!

"Uninteresting"

H_0 - she cannot tell.

Lady's answer

Truth \ Lady's answer	MF	TF
MF	k	$4-k$
TF	$4-k$	k

8 cups.

$2k$ is the number of correct cups.

$k = 0, 1, 2, 3, 4$

$$p(k) = \frac{\binom{4}{k}\binom{4}{4-k}}{\binom{8}{4}}$$

Hypergeometric Distribution

$X = 2k$

k

$p(0) = \frac{1}{70}$ $p(1) = \frac{16}{70}$ $p(2) = \frac{36}{70}$ $p(3) = \frac{16}{70}$

$p(4) = \frac{1}{70}$

Reject the null if [illegible] of observed (or "more extreme" data) is small

$P(X \geq 0) = 1$ $p(X \geq 2) = \frac{69}{70}$ $p(X \geq 4) = \frac{53}{70}$ $p(X \geq 6) = \frac{17}{70}$

$p(X = 8) = \frac{1}{70}$

German Tank Example

Observe tank #s 61 19 56 24 16

Generals think 350 tanks. N - true # tanks

H_0 - $N = 350$

Alternative H_1 - $N < 350$

Statistic

Mean

Max *

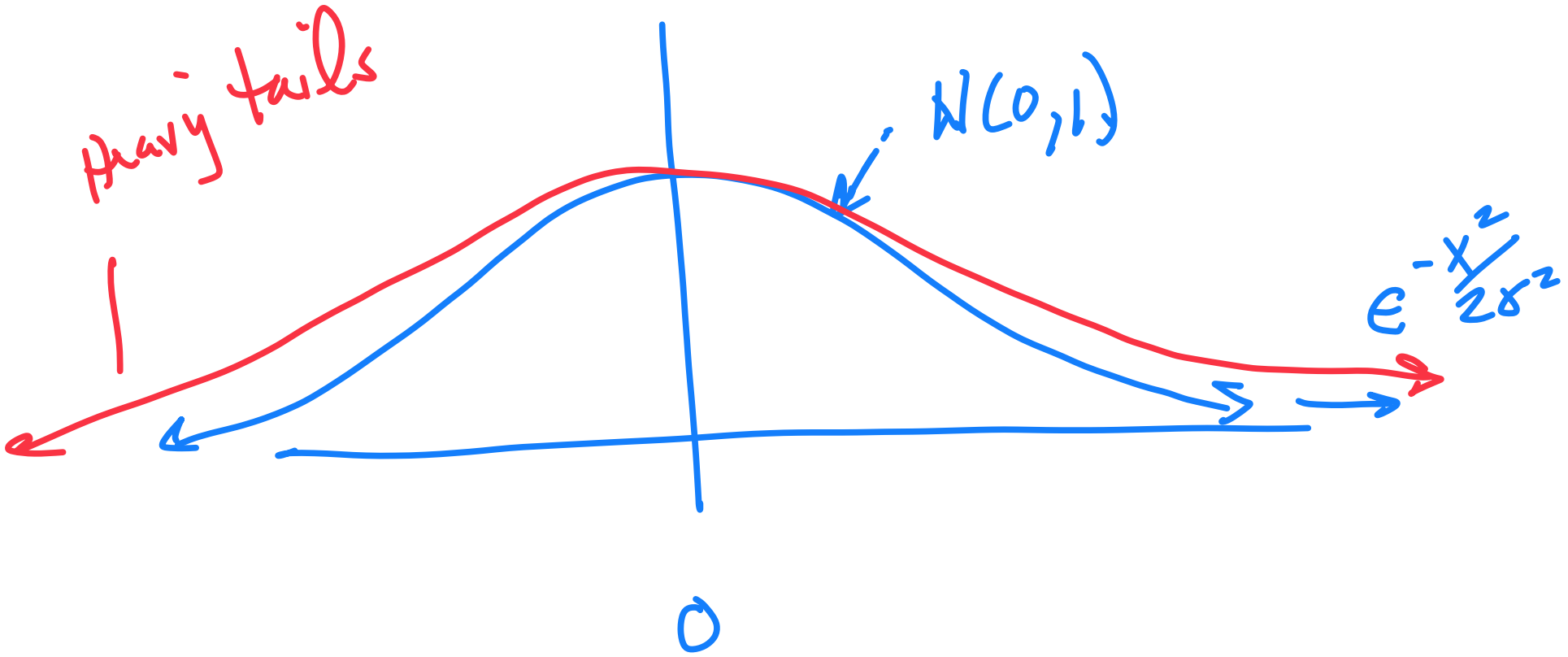
$T_5 = \max(X_1 .. X_5)$

$P(T_5 \le 61)$ $\binom{61}{5} \Big/ \binom{350}{5} = \frac{61 \times 60 \times .. 57}{350 \times 349 .. 346} =$

.00014

Suppose 61, 105, 116, 200, 150

$P(T \le 200) = \binom{200}{5} \Big/ \binom{350}{5} = .0596$


heavy tails
N(0,1)
$e^{-x^2/2\sigma^2}$
0