T-TEST

Hypothesis Testing Framework

1) Setup the Null and Alternate Hypothesis

2) Choose the right test statistic and distribution.

3) Left tailed vs Right tailed vs Two-Tailed

4) Compute P-value

5) If P- value is less than alpha , then reject the null hypothesis.

A french cake shop claims that the average number of pastries they can produce in a day exceeds 500. The average number of pastries produced per day over a 70 day period was found to be 530. Assume that the population standard deviation for the pastries produced per day is 125. Test the claim using a z-test with the critical z-value = 1.64 at the alpha (significance level) = 0.05, and state your interpretation.

$H_0: \mu = 500$

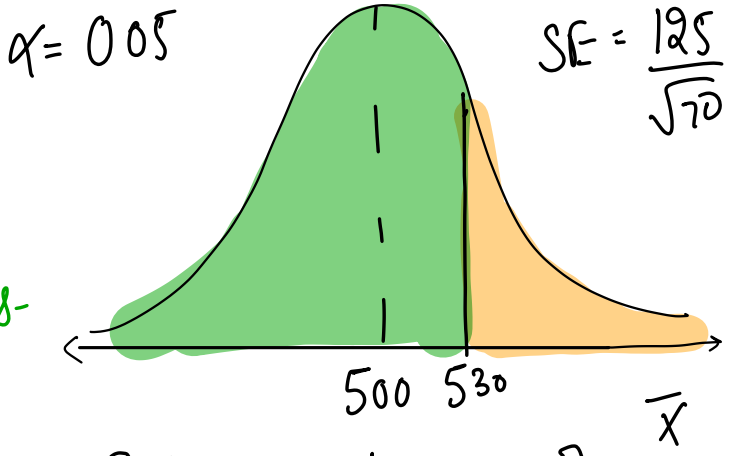
$H_a: \mu > 500$

Test statistics: Sample means of 70 days

distribution: Gaussian

observed value: 530

Right Tailed



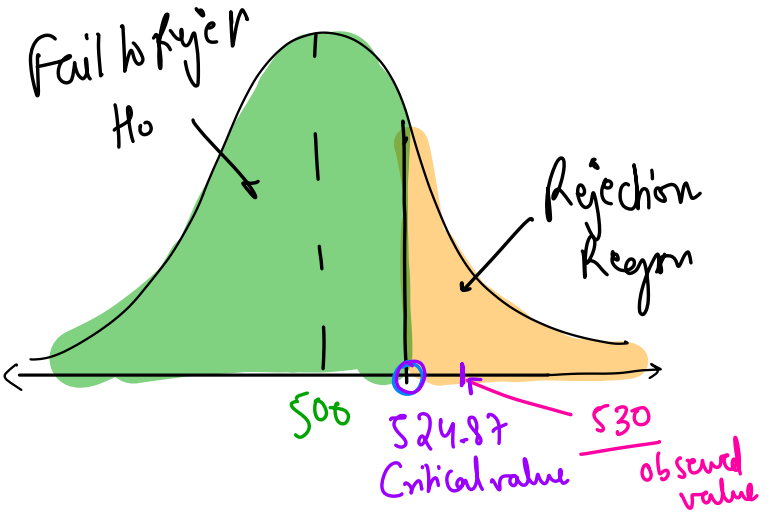
$P[\bar{x}_{obs} > 530 \mid H_0 \text{ is true}]$

(1) $z = \dfrac{530 - 500}{125/\sqrt{70}}$

② Critical Value

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

$$\bar{x} = \mu + Z \frac{\sigma}{\sqrt{n}}$$



Reject Ho

"Improve IQ with this blue pill."

Try on a few individuals.

Avg IQ of human = 100

110, 95, 98, 112, 102, 103, 99, 115 V/S 100

1 Samp

pop

H_0: $\mu = 100$ (pill had no effect)

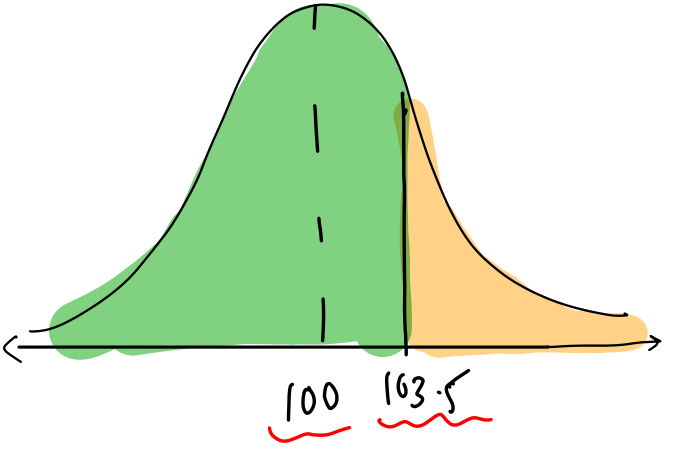
H_a: $\mu > 100$ (pill had an effect)

Right tailed test

Test Statistics → Sample mean of 8 people → 103.5

$$Z = \frac{103.5 - 100}{\sigma / \sqrt{8}}$$

σ → Missing



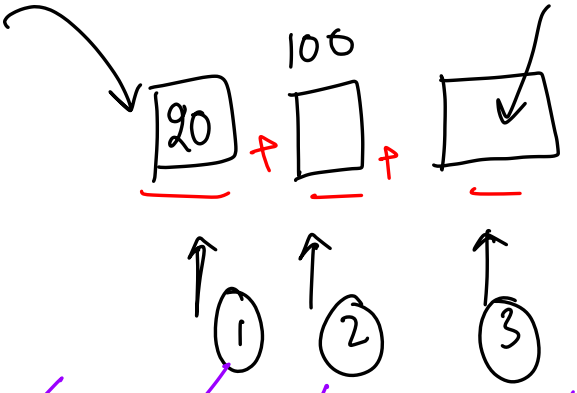
$$T\_stat = \frac{103.5 - 100}{S / \sqrt{8}}$$

"This is NOT se"

S → Sample Standard deviation

Degree of freedom → Chi square test

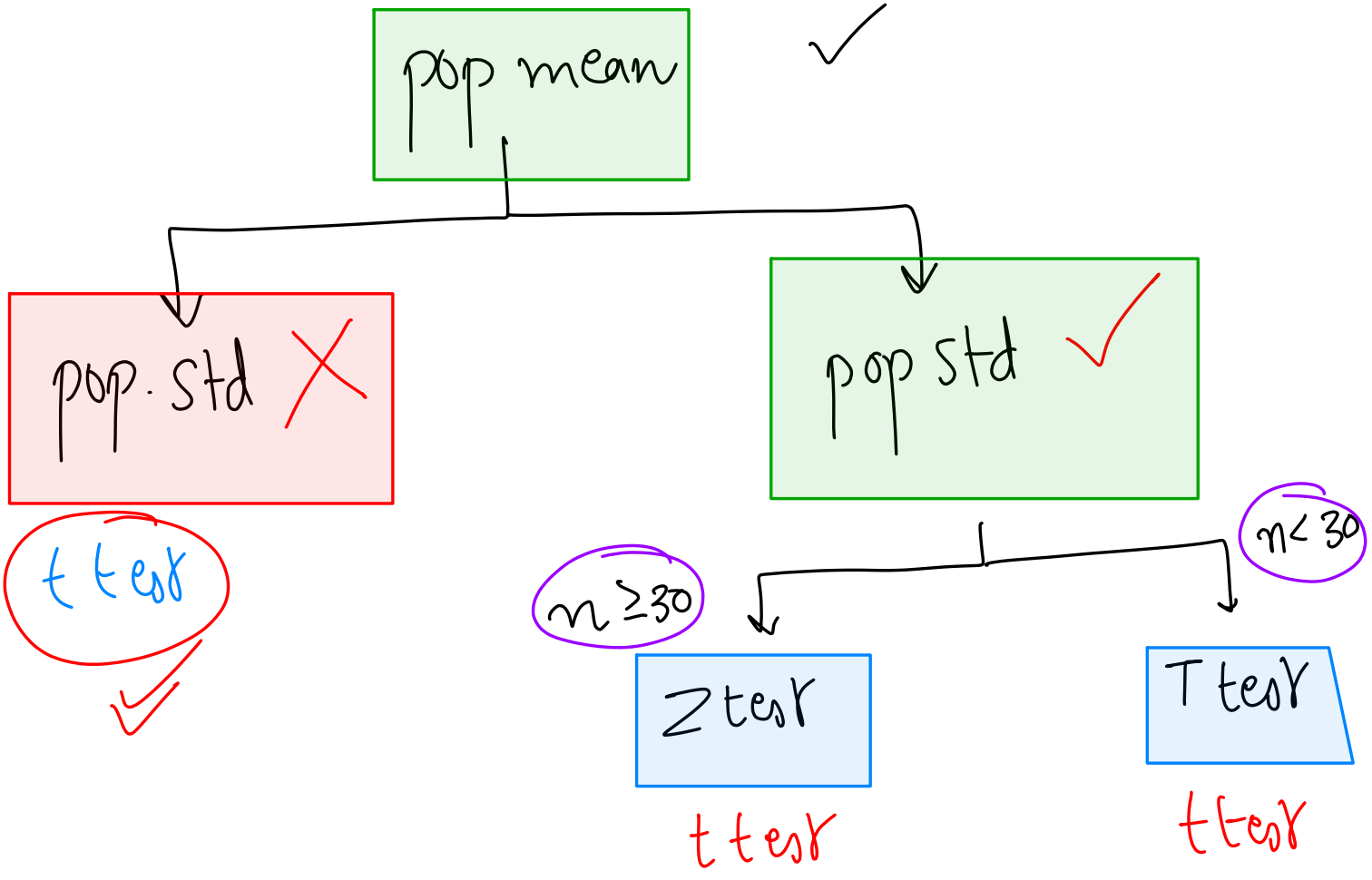
1 — 2 — 3 = 20 — n



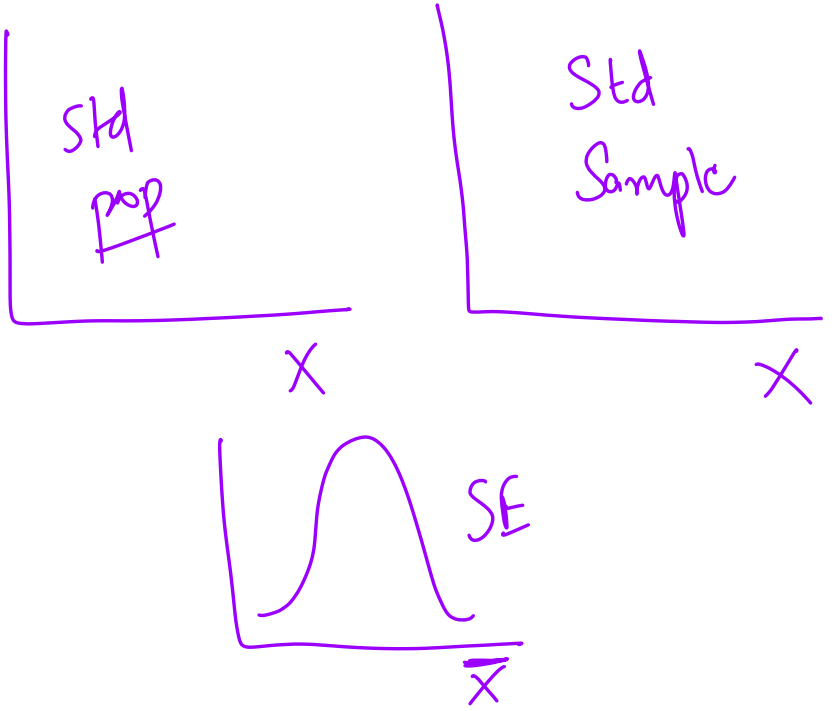
n

degree of freedom = n-1

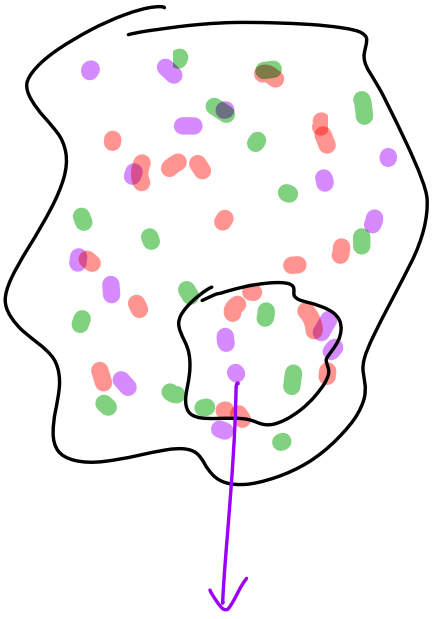
1 — 2 3 — 4 — 5 — 6 — 7 = 1


pop mean
pop. std
t test
pop std
n ≥ 30
Z test
t test
n < 30
T test
t test

SE : Standard deviation of Sample means.



σ
pop. Std



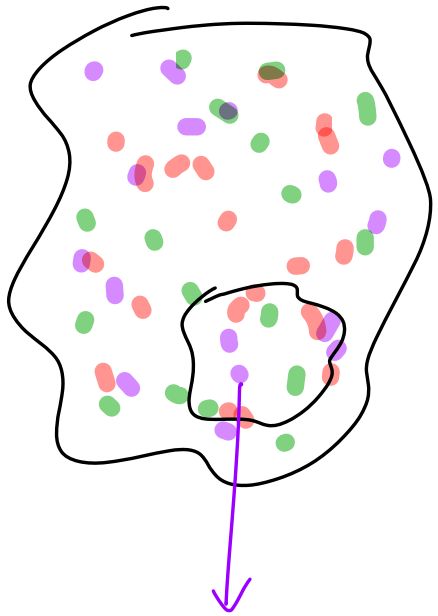
s
sample standard deviation

$x_1 \quad x_2 \quad x_3 \quad x_4 \quad \cdots \quad x_n$

$$\text{Var}(\text{Sample}) = \sum \frac{(x-\bar{x})^2}{n-1}$$

$$\text{Std}(\text{Sample}) = \sqrt{\sum \frac{(x-\bar{x})^2}{n-1}}$$

σ
pop. Std



S sample standard deviation

T-Test

ttest_1samp

1. 1 Sample $\bar{x}$ v/s pop X

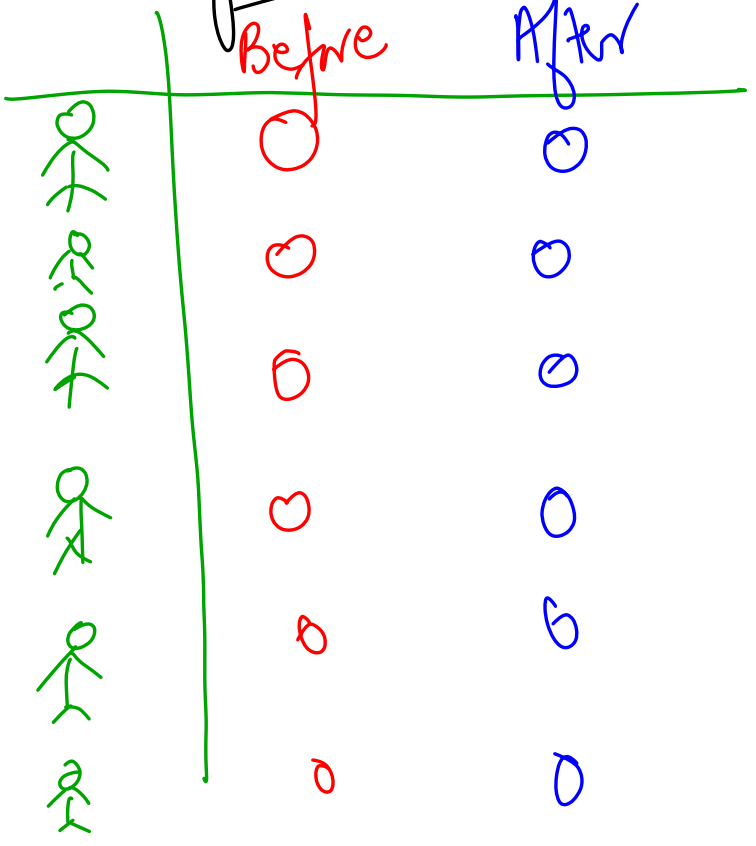
Independent

2. 1st Sample μ_1 v/s μ_2 2nd Sample — ttest_ind

3. 1st Sample μ_1 v/s μ_2 2nd Sample — ttest_rel

Related

Gym owner lose > 5 in 1 month

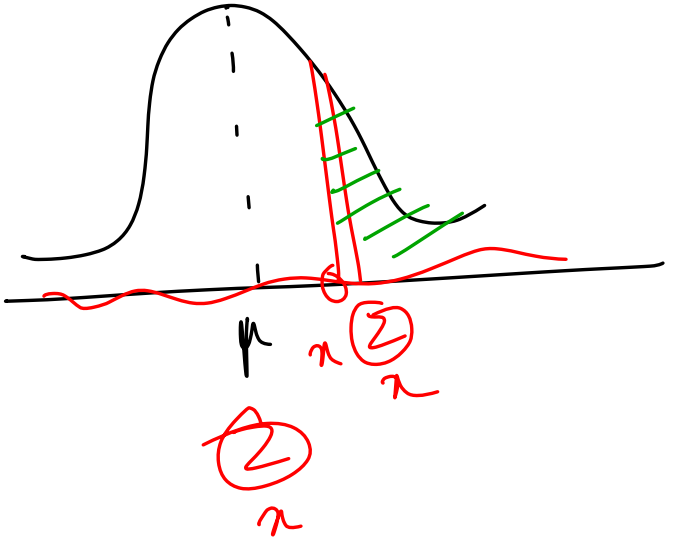


paired T test.

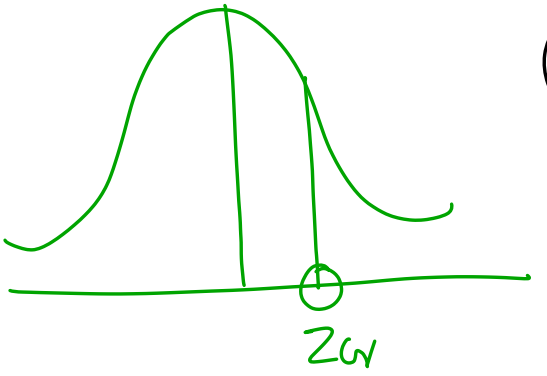
X_1	X_2
0	0
0	0
0	0
0	0
0	0
0	0
	0
	0
	0
	0
$n=6$	$n=10$

Sachin's

1st innings	2nd innings
0	0
0	0
0	0
0	0
0	0
0	0



x, z, p

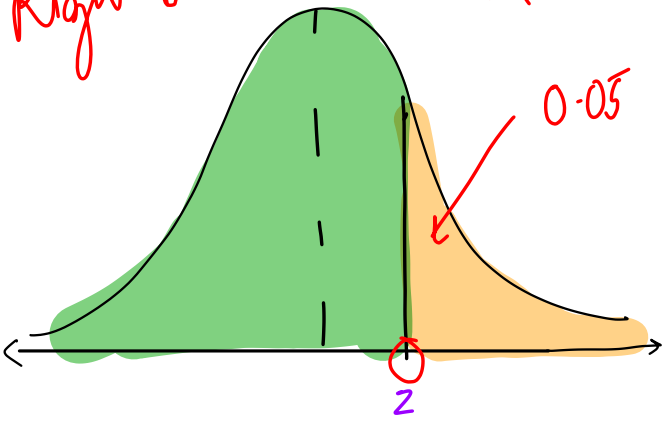


$z \geq z_\alpha$

Right tail Two tail

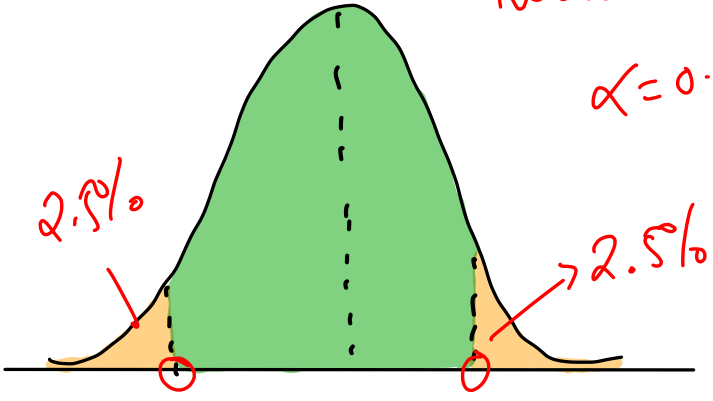
Right tailed

$\alpha = 0.05$

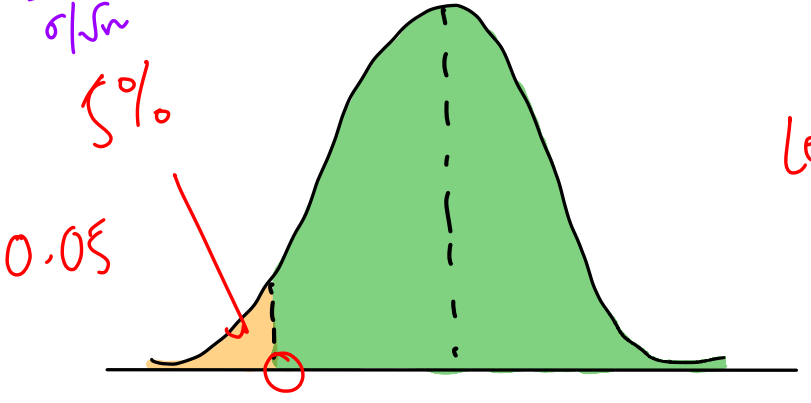


Two tailed

$\alpha = 0.05$



$Z_{obs} = \frac{x - \mu}{\sigma/\sqrt{n}}$



Left tailed