Exercise #10

Q1: A study was made of a random sample of 25 records of patients seen at a chronic disease hospital on an outpatient basis, the mean number of outpatient visits per patient was 4.8 with standard deviation was 2. Can it be concluded from these data that the population mean is greater than four visits per patient. Let the probability of committing **a type I error be 0.05** and assume population distributed normally.

Given that : $H_A: \mu > 4 \;\; ; \mu_0 = 4$
$n = 25 , \bar{X} = 4.8, S = 2$

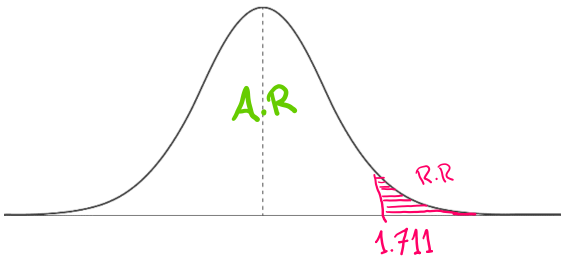
Normal distribution

1-what is the assumption?

$Normal\,, \; \boldsymbol{\sigma}\; unknown\,, \; \boldsymbol{n}\; small$

2-Hypothesis is?

$H_0: \mu \leq 4$, $H_A: \mu > 4$



3-Test statistic =

$$T = \frac{\bar{X} - \mu_0}{S/\sqrt{n}} = \frac{4.8-4}{\frac{2}{\sqrt{25}}} = 2$$

4-Reject H_0 if $T > t_{1-\alpha, n-1} = 1.711$

$\alpha = 0.05 \;\; and\; df = n - 1 = 24$

$t_{1-0.05} = t_{0.95,\;24} = 1.711$

5-conclusion is:

since $T = 2 > t_{0.95,\;24} = 1.711$

a)reject H_0 b)accept H_0

Q2: In a sample of **49** adolescents who served as the subjects in an immunologic study, one variable of interest was the diameter of a skin test reaction to an antigen. The sample mean and standard deviation were **21** and **11** mm erythematic, respectively. Can it be concluded from these data that <u>the population mean is less than 30 ?</u> **let α=0.05**

Given that : H_A: μ < 30 ; $\mu_0 = 30$
$n = 49$, $\bar{X} = 21$, $S = 11$; $\alpha = 0.05$

1-what is the assumption?

Non-Normal , σ unknown , n large

2-Hypothesis is?

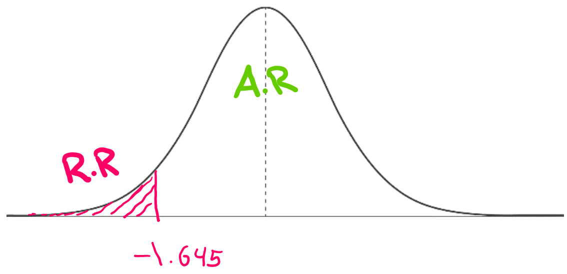
H_0: μ ≥ 30 , H_A: μ < 30

3-Test statistic=

$$Z = \frac{\bar{X}-\mu_0}{\sigma/\sqrt{n}} = \frac{21-30}{\frac{11}{\sqrt{49}}} = -5.727$$

4-Reject H_0 if $Z < -Z_{1-\alpha} = -1.645$

$\alpha = 0.05 \; then \; Z_{1-0.05} = -Z_{0.95} = -1.645$



5-conclusion is:

$since \; Z < -1.645$

a) reject H_0 **b)accept H_0**

Q3: A survey of **100** similar-sized hospitals revealed a **mean** daily census in the pediatrics service of **27**. The population distributed normally with standard deviation of **6.5**. Do these data provide sufficient evidence to indicate that the population mean is not equal **25 ?** **let α=0.05**

Given that : $H_A: \mu \neq 25$; $\mu_0 = 25$
$n = 100$, $\bar{X} = 27, \sigma = 6.5$

Normal distribution

1-what is the assumption?

Normal , σ known , n large

2-Hypothesis is?

H_0: μ = 25 , **H_A: μ ≠ 25**

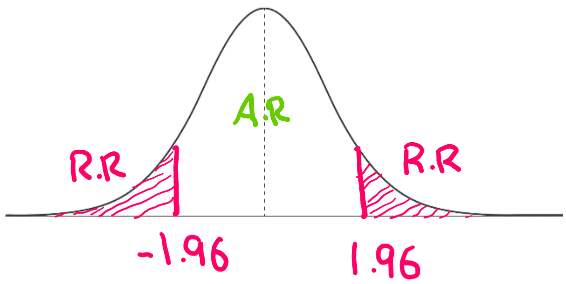
3-Test statistic=

$$\boldsymbol{Z = \frac{\bar{X}-\mu_0}{\sigma/\sqrt{n}} = \frac{27-25}{\frac{6.5}{\sqrt{100}}} = 3.077}$$

4-Rejection region is

$$(-\infty, -\mathbf{1.96})\ \boldsymbol{U}\ (\mathbf{1.96}, \infty)$$

$$\alpha = 0.05\ \ then\ Z_{1-\alpha/2} = Z_{0.975} = 1.96$$



5-conclusion is:

a)reject H_0 b)accept H_0

6- P-value =

$$\boldsymbol{2\,P(\,Z\ >\ |Z|) =\ 2P(Z\ >\ 3.08) = 2\ \times [1 - P(Z < 3.08)]}$$

$$\boldsymbol{= 2\ \times [1 - 0.99896] = 2\ \times [0.00104]\ = 0.00208}$$

since p-value = $\boldsymbol{0.00208\ <\ 0.05 =\ \alpha}$

then we reject $\boldsymbol{H_0}$**: μ** $\boldsymbol{= 25}$

<u>H.W 1:</u>

A research team is willing to assume that systolic blood pressures in a certain population of males are approximately normally distributed with a standard deviation of 16. A simple random sample of 64 males from the population had a mean systolic blood pressure reading of 133 . At the 0.05 level of significance, do these data provide sufficient evidence for us to conclude that the population mean is greater than 130.

1-what is the assumption? **(Answer: Normal , σ known , n large)**

2-Hypothesis is? **(Answer: H_0: $\mu \leq 130$, H_A: $\mu > 130$)**

3-Test statistic= **(Answer: $Z = 1.5$)**

4-Reject H_0 if **(Answer: $Z > Z_{1-\alpha}$)**

5-conclusion is:

a)reject H_0 <u>b)accept H_0</u>

Q4: The objective of a study by Sairam et al. (A-8) was to identify the role of various disease states and additional risk factors in the development of thrombosis. One focus of the study was to determine if there were differing levels of the anticardiolipin antibody IgG in subjects with and without thrombosis.

Group	Mean IgG Level (ml/unit)	Sample Size	Population Standard deviation
Thrombosis	59.01	53	44.89
No thrombosis	46.61	54	34.85

We wish to know if we may conclude, on the basis of these results, that, in general, persons with thrombosis have, on the average, **higher** IgG levels than persons without thrombosis. **let α=0.01**

Given that : $H_A: \mu_1 > \mu_2$; $\mu_0 = 0$

1-what is the assumption?

Not -Normal , σ_1 , σ_2 known , n_1, n_2 large

2-Hypothesis is?

$H_0: \mu_1 \leq \mu_2$, $H_A: \mu_1 > \mu_2$

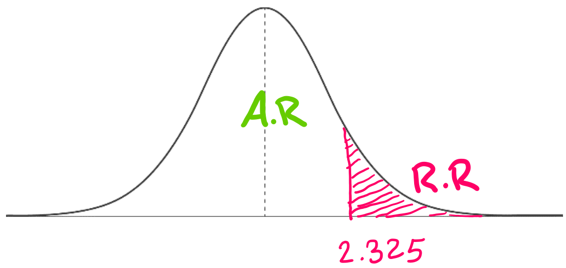
3-Test statistic=

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{59.01 - 46.61}{\sqrt{\frac{44.89^2}{53} + \frac{34.85^2}{54}}} = 1.59$$

4-Acceptance region is?

$$\alpha = 0.01 \text{ then } Z_{1-0.01} = Z_{0.99} = \frac{2.32 + 2.33}{2} = 2.325$$

then the Acceptance region is **(-∞ , 2.325)**



5-conclusion is:

a) **Reject H0** **b) Accept H_0**

Q5: A test designed to measure mothers' attitudes toward their labor and delivery experiences was given to two groups of new mothers. Sample 1 (attenders) had attended prenatal classes held at the local health department. Sample 2 (nonattenders) did not attend the classes. The sample sizes and means and standard deviations of the test scores were as follows:

sample	n	$\bar{x}$	S
1	15	4.75	1.0
2	22	3.00	1.5

Do these data provide sufficient evidence to indicate that attenders, on the average, score **less** than non attenders **by 2** ? Assume normal population with equal variances.

Let α =0.05

Given that : $H_A: \mu_1 - \mu_2 < 2$; $\mu_0 = 2$

1-what is the assumption?

Normal , σ_1 , σ_2 unknown , n_1, n_2 small

2-Hypothesis is?

$H_0: \mu_1 - \mu_2 \geq 2$, $H_A: \mu_1 - \mu_2 < 2$

3- find pooled variance

$$S_P^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2} = \frac{14*1+21*1.5^2}{15+22-2} = 1.75$$

4-Test statistic=

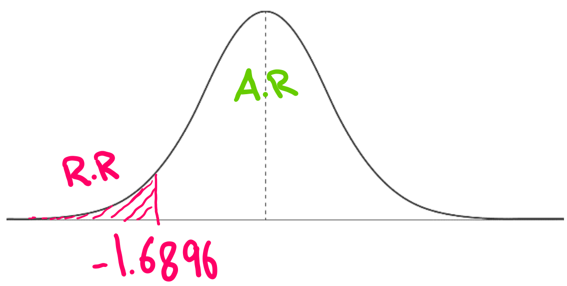
$$T = \frac{\bar{X}_1-\bar{X}_2-(\mu_1-\mu_2)}{\sqrt{\frac{S_P^2}{n_1}+\frac{S_P^2}{n_2}}} = \frac{4.75-3-2}{\sqrt{\frac{1.75}{15}+\frac{1.75}{22}}} = 0.5644$$

5-Reject H_0 if

$$T < -t_{1-\alpha} = -t_{0.95} = -1.6896$$

$$\alpha = 0.05 \ and \ df = n_1 + n_2 - 2 = 35$$

$$then \ t_{1-0.05} = t_{0.95} = -1.6896$$



6-conclusion is:

a)Reject H_0 **b)Accept H_0**

H.W 2:

Cortisol level determinations were made on two samples of women at childbirth. Group 1 subjects underwent emergency cesarean section following induced labor. Group 2 subjects delivered by either cesarean section or the vaginal route following spontaneous labor. The sample sizes, mean cortisol levels, and standard deviations were as follows:

sample	n	$\bar{x}$	S
1	10	435	65
2	12	645	80

Assume equal variances . Do these data provide sufficient evidence to indicate a difference in the mean cortisol levels in the populations represented? Let $\alpha=0.05$, Assume normal populations

1-what is the assumption?

(Answer: Normal , σ_1 , σ_2 unknown , n_1, n_2 small)

2-Hypothesis is?

(Answer: H_0: $\mu_1 = \mu_2$, H_A: $\mu_1 \neq \mu_2$)

3- find pooled variance

(Answer: $S_p^2 = 5421.25$)

4-Test statistic=

(Answer: T = - 6.716)

5-Acceptance Region is

(Answer: (-2.086 , 2.086)

6-conclusion is:

a)reject H_0 **b)accept H_0**

Q6: Woo and McKenna (A-18) investigated the effect of broadband ultraviolet B (UVB) therapy and topical calcipotriol cream used together on areas of psoriasis. One of the outcome variables is the Psoriasis Area and Severity Index (PASI). The following table gives the PASI scores **for 20 subjects** measured at baseline and after eight treatments. Do these data provide sufficient evidence, at the **0.01 level of significance**, to indicate that the combination therapy ***reduces*** PASI scores? (Note assume population is normal)

Given that : $H_A: \mu_x > \mu_y$

Two related Normal populations

Let **X=** the PASI scores of subjects measured at baseline **(before)**

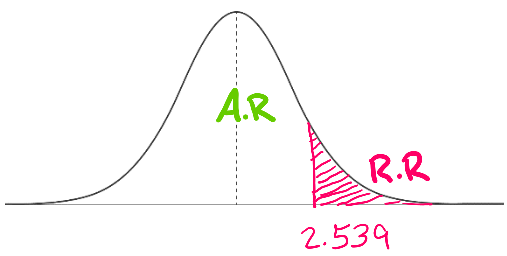
Y= the PASI scores for subjects measured **after** eight treatments.

subject	Baseline (X)	After 8 treatments (Y)	D= X-Y
1	5.9	5.2	0.7
2	7.6	12.2	-4.6
3	12.8	4.6	8.2
4	16.5	4.0	12.5
5	6.1	0.4	5.7
6	14.4	3.8	10.6
7	6.6	1.2	5.4
8	5.4	3.1	2.3
9	9.6	3.5	6.1
10	11.6	4.9	6.7
11	11.1	11.1	0
12	15.6	8.4	7.2
13	6.9	5.8	1.1
14	15.2	5.0	10.2
15	21.0	6.4	14.6
16	5.9	0.0	5.9
17	10.0	2.7	7.3
18	12.2	5.1	7.1
19	20.2	4.8	15.4
20	6.2	4.2	2

1-Hypothesis is? $H_0: \mu_x \leq \mu_y$, $H_A: \mu_x > \mu_y$

2-Test statistic= $T = \frac{\bar{D}}{S_D/\sqrt{n}} = \frac{6.22}{5.0403/\sqrt{20}} = 5.5189$

$\bar{D} = \frac{\sum_{i=1}^{n} D_i}{n} = 6.22$; $S_D = \sqrt{\frac{\sum_{i=1}^{n}(D_i - \bar{D})^2}{n-1}} = 5.0403$



3-Rejection region is? $(2.539, \infty)$

$\alpha = 0.01$ $df = n - 1 = 19$; $t_{1-\alpha} = t_{0.99} = 2.539$

4-conclusion is:

a) **reject H_0** b) **accept H_0**

SO, the therapy reduces PASI scores.

H.W3

One of the purposes of an investigation by Porcellini et al. (A-19) was to investigate the effect on CD4 T cell count of administration of intermittent interleukin (IL-2) in addition to highly active antiretroviral therapy (HAART). The following table shows the CD4 T cell count at baseline and then again after 12 months of HAART therapy with IL-2. Do the data show, at the .05 level, a significant change in CD4 T cell count?

Subject	1	2	3	4	5	6	7
CD4 T cell count at entry	**173**	**58**	**103**	**181**	**105**	**301**	**169**
CD4 T cell count at end of follow-up	**257**	**108**	**315**	**362**	**141**	**549**	**369**
D=x-y	-84	-50	-212	-181	-36	-248	-200

1-Hypothesis is?

(Answer: H_0: $\mu_x = \mu_y$, H_A: $\mu_x \neq \mu_y$)

2-Test statistic=

$$T = \frac{\bar{D}}{S_D/\sqrt{n}} = \frac{-144.43}{85.677/\sqrt{7}} - 4.46$$

4-Rejection region is?

(-∞ ,- 2.447) U (2.447 ,∞)

5-conclusion is:

a)reject H_0 b)accept H_0

<u>Q7</u>: Jacquemyn et al. (A-21) conducted a survey among gynecologists-obstetricians in the Flanders region and obtained **295** responses. Of those responding, **90** indicated that they had performed at least one cesarean section on demand every year. <u>Does this study provide sufficient evidence for us to conclude that ***less than 35*** percent</u> of the gynecologists-obstetricians in the Flanders region perform at least one cesarean section on demand each year? Let **α =0.05.**

Given that : $\hat{p} = \frac{x}{n} = \frac{90}{295} = 0.305$

$\boldsymbol{H_A: P < 0.35 \ ; P_0 = 0.35}$

1-Hypothesis is?

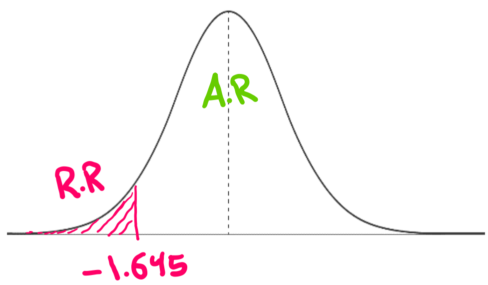
H_0: P ≥ 0.35 , H_A: P < 0.35

2-Test statistic=

$$Z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0 q_0}{n}}} = \frac{0.305-0.35}{\sqrt{\frac{0.35*0.65}{295}}} = -1.62$$

3-Rejection region is **(- ∞ , -1.645)**

$$\alpha = 0.05 \text{ then } Z_{1-0.05} = Z_{0.95} = \frac{1.64 + 1.65}{2} = 1.645$$



4-conclusion is:

a) reject H_0 **b) accept H_0**

6- P-value =

$$\boldsymbol{P(Z > -Z_C) = P(Z > -(-1.62)) = 1 - P(Z < 1.62) = 1 - 0.94845 = 0.05155}$$

Since p-value > $\boldsymbol{\alpha = 0.05}$, then we can not reject H_0 .

H.W4

In an article in the journal Health and Place, Hui and Bell (A-22) found that among 2428 boys ages 7 to 12 years, 461 were overweight or obese. On the basis of this study, can we conclude that more than 15 percent of the boys ages 7 to 12 in the sampled population are obese or overweight? Let $\alpha=0.05$

1-Hypothesis is? **(Answer : H_0: $P \leq 0.15$, H_A: $P > 0.15$)**

2-Test statistic= **(Answer : $Z = 5.52$)**

3-Acceptance region is **(Answer : $(-\infty , 1.645)$)**

4-conclusion is:

a)reject H_0 **b)accept H_0**

Q8: Ho et al. (A-25) used telephone interviews of randomly selected respondents in Hong Kong to obtain information regarding individuals' perceptions of health and smoking history. Among **1222** current male smokers, **72** reported that they had "poor" or "very poor" health, while **30** among **282** former male smokers reported that they had "poor" or "very poor" health. Is this sufficient evidence to allow one to conclude that among Hong Kong men there is a **difference between** current and former smokers with respect to the proportion who perceive themselves as having "poor" and "very poor" health? Let α=**0.01**.

Given that : $\widehat{p_1} = \frac{x_1}{n_1} = \frac{72}{1222} = 0.0589$; $\widehat{p_2} = \frac{x_2}{n_2} = \frac{30}{282} = 0.1064$; $\boldsymbol{H_A: P_1 \neq P_2}$

1-Hypothesis is?

H_0: $P_1 = P_2$, H_A: $P_1 \neq P_2$

2-Test statistic=

$$\bar{p} = \frac{X_1 + X_2}{n_1 + n_2} = \frac{72 + 30}{1222 + 282} = 0.0678 \quad , \qquad \bar{q} = 1 - 0.068 = 0.9322$$

$$\boldsymbol{Z} = \frac{(\hat{p}_1 - \hat{p}_2)}{\sqrt{\frac{\bar{p}\bar{q}}{n_1} + \frac{\bar{p}\bar{q}}{n_2}}} = \frac{\mathbf{0.0589 - 0.1064}}{\sqrt{\frac{\mathbf{0.0678 * 0.9322}}{\mathbf{1222}} + \frac{\mathbf{0.0678 * 0.9322}}{\mathbf{282}}}} = \mathbf{-2.8599}$$

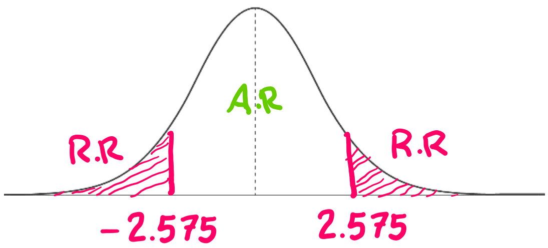
3-Acceptance region is?

$(-2.575, 2.575)$

$\alpha = 0.05 \;\; then \;\; Z_{1-\frac{0.05}{2}} = Z_{0.995} = \frac{2.57+2.58}{2} = 2.575$

$Reject\ H_0\ \ if\ :\ \ Z < -Z_{1-\frac{\alpha}{2}}\ \ or\ \ Z > Z_{1-\frac{\alpha}{2}}$

$and\ Accept\ H_0\ if\ \ -Z_{1-\alpha/2} < Z < Z_{1-\alpha/2}$



4-conclusion is:

a) reject H_0 b)accept H_0

H.W5:

In a study of obesity the following results were obtained from samples of males and females between the ages of 20 and 75:

	n	Number overweight
Males	**150**	**21**
Females	**200**	**48**

Can we conclude from these data that in the sampled populations there is a difference in the proportions who are overweight? Let $\alpha = 0.05$.

1-Hypothesis is?

$H_0: P_1 = P_2$, $H_A: P_1 \neq P_2$

2-Test statistic=

$Z = -2.328$

3-Acceptance region is?

(- 1.645 , 1.645)

6-conclusion is:

a)reject H_0 b)accept H_0