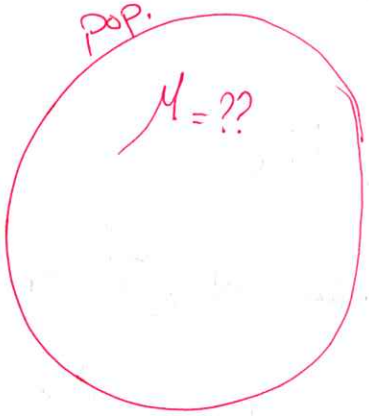
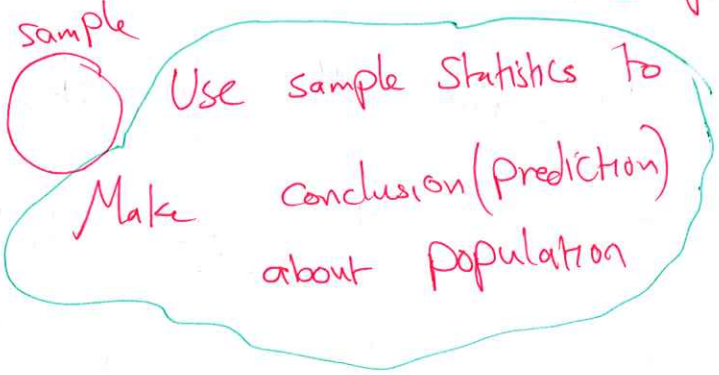
Chapter 9: Hypothesis testing

9.1

We will use sample to test hypothesis about μ.





In any hypothesis testing, there are two hypotheses:

1. The Null hypothesis : H_0 : is the researcher claim
2. The Alternative hypothesis :- H_a :- is the opposite of H_0

9.2 Type I and Type II

Researcher \ conclusion	H_0 True	H_0 False
Reject H_0	Type I Error	Correct conclusion
Accept H_0	Correct conclusion	Type II error

STUDENTS-HUB.com Uploaded By: 1210711@student.birzeit.edu

Def * Def:- Type I error:- Rejecting H_0 when H_0 is True

significance level α = the prob. of Making type I error

Type II error: Accepting H_0 when H_0 is False

9.3 مطلوب σ Known

9.4 غير مطلوب σ Un Know

In general, the steps for testing are:—

(1) Write the hypotheses H_0, H_a.

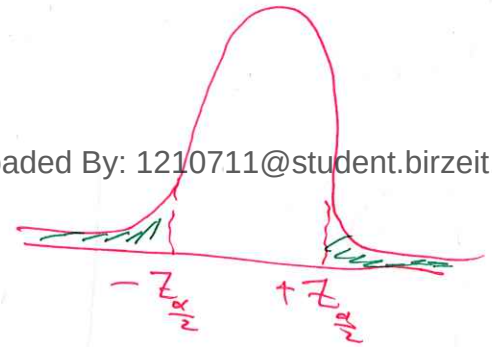
(2) Find the test statistics: a value of (Z) مطلوب or (t) غير مطلوب

(3) Test Using Critical value or P-value Approach

(4) Conclusion

σ: known
test statistics is $Z = \dfrac{\bar{X} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$

*** Hypothesis:- $H_0: \mu = \mu_0$
$H_a: \mu \neq \mu_0$ (two tailed test)



Test Statistics :- $Z = \dfrac{\bar{X} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$

STUDENTS-HUB.com Uploaded By: 1210711@student.birzeit.edu

Critical value : $\pm Z_{\frac{\alpha}{2}}$

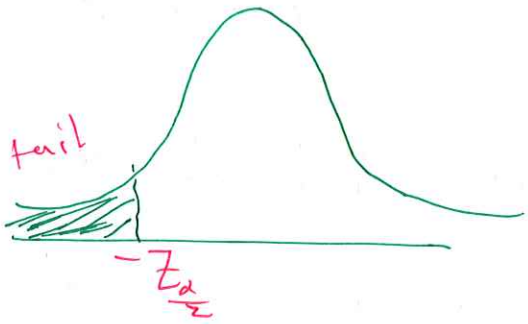
Reject H_0 | Accept H_0 | Reject H_0
$-Z_{\frac{\alpha}{2}}$ $Z_{\frac{\alpha}{2}}$

Conclusion :- Reject $H_0 \rightarrow |Z| \geq Z_{\frac{\alpha}{2}}$

Accept $H_0 \longrightarrow |Z| < Z_{\frac{\alpha}{2}}$

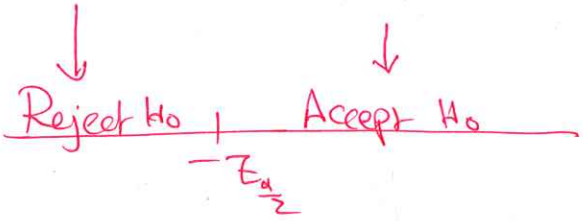
** Hypothesis:- $H_0 : \mu \geq \mu_0$ Lower tailed test

$H_a : \mu < \mu_0$



Test Statistics $Z = \dfrac{\bar{X} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$

Critical value: $-Z_{\frac{\alpha}{2}}$

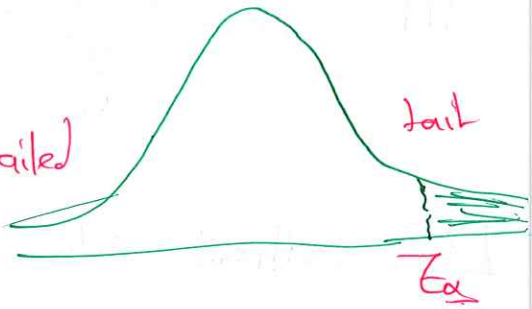


Conclusion $Z \leq -Z_{\frac{\alpha}{2}}$ Reject Ho

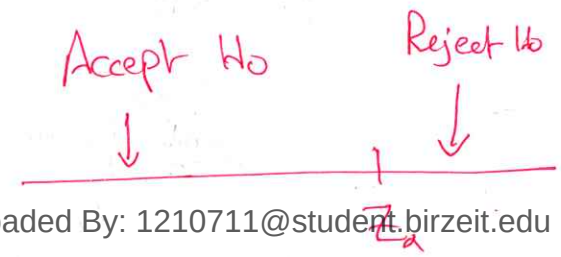
$Z > Z_{\frac{\alpha}{2}}$ Accept Ho

** Hypothesis: $H_0 : \mu \leq \mu_0$ upper tailed test

$H_a : \mu > \mu_0$



test statistics: $Z = \dfrac{\bar{X} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$



STUDENTS-HUB.com Uploaded By: 1210711@student.birzeit.edu

Critical value $Z \geq Z_\alpha$ Reject Ho

$Z < Z_\alpha$ Accept Ho.

Ex:- $H_0 = \mu \leq 20$

$H_a: \mu > 20$

given that $n = 35$

$\bar{x} = 23$

$\sigma = 4.5$ (norm)

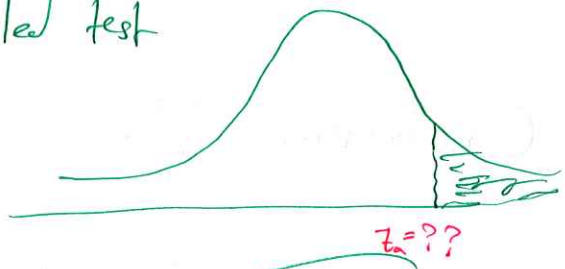
$\alpha = 10\%$

1. Find the test statistics.
2. Find the Critical value
3. What is your conclusion

Hypothesis $H_0 = \mu \leq 20$

$H_1 = \mu > 20$

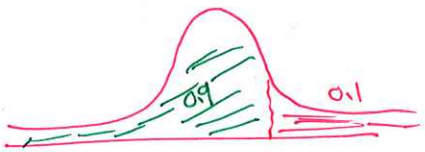
upper tailed test



1. $Z = \dfrac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}} = \dfrac{23 - 20}{\frac{4.5}{\sqrt{35}}} = 3.94$

2. Critical value $Z_\alpha = ??$

$\alpha = 0.10 \longrightarrow Z_{0.1}$



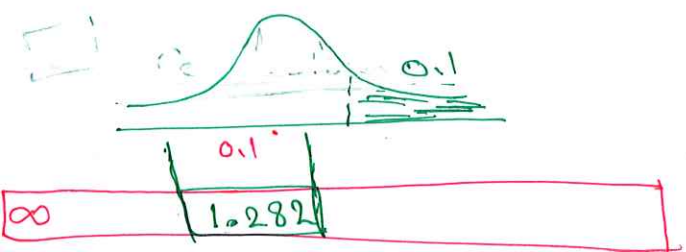
بالطريقة الاولى باستخدام Z table

لا احتاج لـ قيمة n في جدول Z

STUDENTS-HUB.com Uploaded By: 1210711@student.birzeit.edu

	0.08	0.09
1.2	0.8997	0.9015

$Z_\alpha = Z_{0.1} = 1.28$



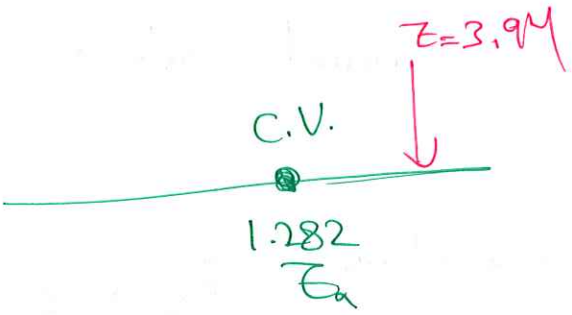
الطريقة الثانية . باستخدام t table

$\left[t_{\alpha, Df=\infty} = Z_\alpha \right]$ يجوز اخذ قيمة مهما كانت قيمة n

[3] Conclusion: $Z \geq Z_\alpha$

$3.94 \geq 1.282$

Reject H_0



Exp: $H_0: \mu = 80.42$

$H_a: \mu \neq 80.42$

given that Sample Size = 100

$\bar{X} = 81$

$\sigma = 15.2$

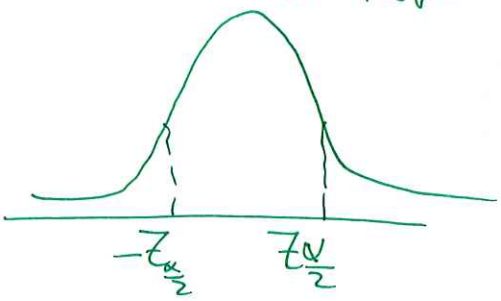
$\alpha = 1\%$

[1] Find the test statistics

[2] At 1% significance level, what is your conclusion By using critical value Approach

Solution • $Z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} = \frac{81 - 80.42}{15.2/\sqrt{100}} = 0.38$

two tailed test



• Critical value $\pm Z_{\frac{\alpha}{2}}$

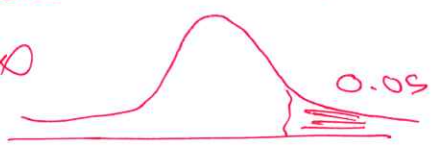
$\alpha = 0.01 \longrightarrow \frac{\alpha}{2} = 0.005$

$Z_{0.005}$

STUDENTS-HUB.com Uploaded By: 1210711@student.birzeit.edu

t table

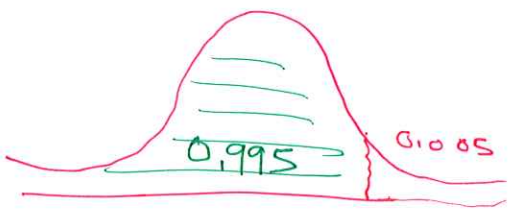
$D_f = \infty$



0.005

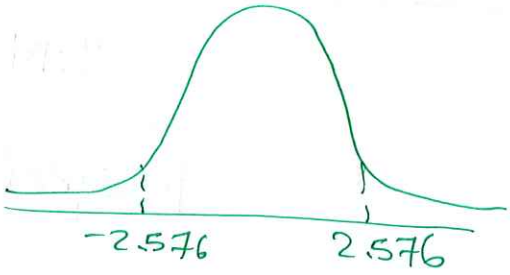
∞	2.576

Z table



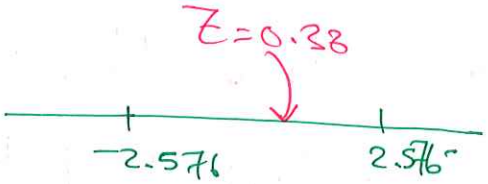
	0.07	0.08
2.5	0.9949	0.9951

Critical value = ± 2.576



- conclusion: $-Z_{\frac{\alpha}{2}} < Z < Z_{\frac{\alpha}{2}}$

Accept H_0 (Don't Reject H_0)



STUDENTS-HUB.com Uploaded By: 1210711@student.birzeit.edu