University of Jordan
Faculty of Medicine
Batch 2013-2019

Medical Committee
The University of Jordan

Epidemiology & Biostatistics

○ Slides ○ Sheet ● Handout ○ other....................

Number #1

Title: Outline + Dr. Ahmad Material

Dr.

Done By:

Date:

Price:

Designed by Nadeen Al-Freihat

Hypothesis testing will be presented as a nine-step procedure:

1) Data. * What is the nature of the data?
* Whether the data consist of counts or measurements must be determined.
① (Evaluate the data)

2) Assumptions. assumptions about the normality of the population distribution, equality of variances, and Independence of samples.
② (Review assumptions)

3) Hypotheses. ③ (State Hypotheses)

There are two statistical hypotheses involved in hypothesis testing:

a) the Null Hypothesis (Ho). ⇒ Hypothesis of No difference, No association, No Relationship the Variables are Independent.

* In the testing process the Ho either is rejected or is not rejected (failed to reject) or (Accepted).

* If the Ho is not rejected we will say that the data on which the test is based do not provide sufficient evidence to cause rejection.

* An Indication of equality (=, ≤, ≥) must appear in the Ho.

b) the Alternative Hypothesis (H_A).

e.g: we want to answer the question:

* Can we conclude that a certain population mean is not 50?

$H_0: \mu = 50$

$H_A: \mu \neq 50$

* The population mean is greater than 50.

$H_0: \mu \leq 50$; $H_A: \mu > 50$

* The population mean is less than 50.

$H_0: \mu \geq 50$; $H_A: \mu < 50$

4) Test Statistic. (4) (Select test statistic)

* Some statistic that may be computed from the data of the sample.

$$\underline{Z} = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} \; ; \; \underline{t} = \frac{\bar{X} - \mu}{S/\sqrt{n}}$$

Tests

* – Normal Z
* – Normal t
* – Chi-squared χ^2

Test Statistic = $\dfrac{\text{Relevant Statistic} - \text{Hypothesized parame}}{\text{Standard Error of the Relevant Statistic}}$

) Distribution of the Test Statistic.

(5) (Determine Distribution of Test statistic)

- Unit Normal Distribution or Not.

6) Decision Rule. (6) (State Decision Rule)

- Acceptance Region
- Rejection Region

The decision rule tells us to reject the Ho if the value of the test statistic that we compute from our sample is one of the values in the rejection region, and Do not Reject (or Accept) the Ho if the value of test statistic is one of the values in the acceptance region

* See Table for (α, β)

α = level of Significance
= The probability of committing type I error.
= The probability of rejecting a true(null) Ho.

α = 0.05, 0.01, 0.10 ---etc

β = The probability of committing Type II error.

β is allways larger than α.

We never know whether we have committed one of these errors when we reject or fail to reject a null hypothesis, since the true state of affairs is unknown.

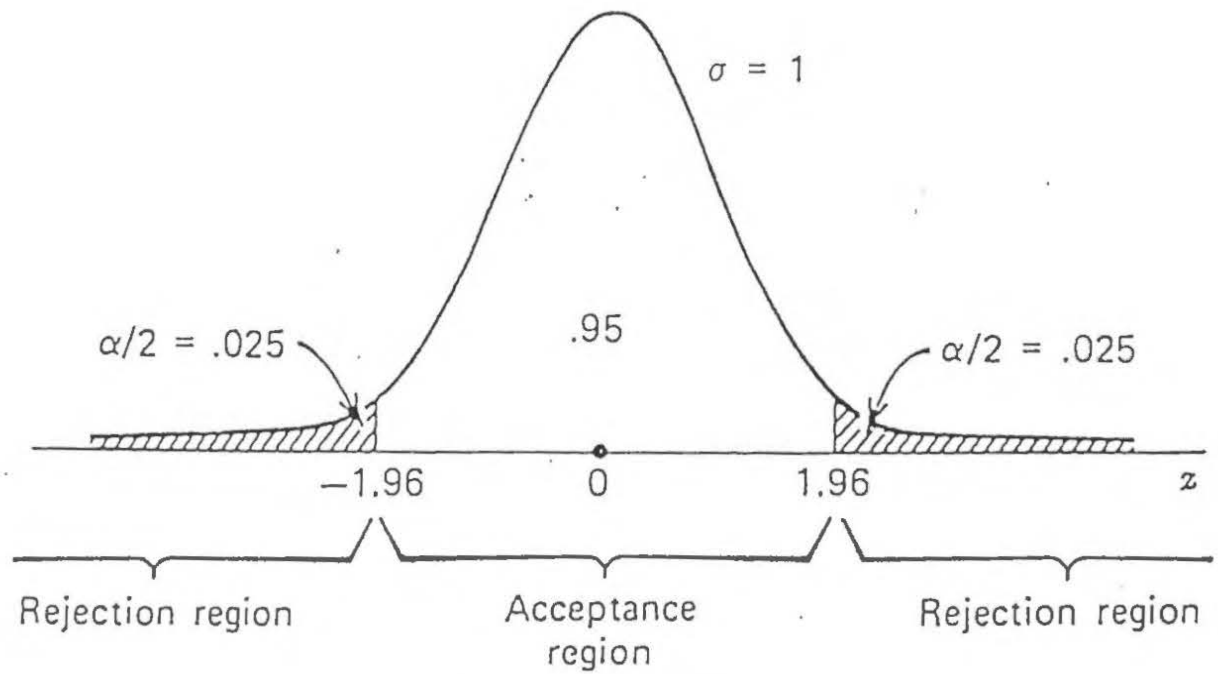

FIGURE 6.2.1

Acceptance and Rejection Regions for Example 6.2.1

level of significance = α = probability of a type I Error. (The more frequently found values of α are 0.05, 0.01, and 0.10).

p-Value: The probability of obtaining, when Ho is true, a value of the test statistic as extreme as or more extreme (in the appropriate direction) than the one actually computed.

e.g Suppose we found that the calculated test statistic $Z = -1.41$

P-value means the exact probability of getting a value as extreme as or more extreme than that observed ($Z = -1.41$) if the Ho is true.

from Table C:

The probability of observing a $Z \geq 1.41$ is 0.0793.

The probability of observing a value of $Z \leq -1.41$ is 0.0793

$P = 0.0793 + 0.0793 = 0.1586$

P = P Value = 0.1586

If $\alpha = 0.05 \Rightarrow$ Do not Reject the Ho

Applications and characteristics

* Statistical Testing is based predominantly on the α error. Many studies use $\alpha = 0.05$
* Sample size (n) determinations depend on α, β, prevalence, σ, the amount of difference to be detected (Effect size).
* Multiple comparisons and repeated testing for significance increase the likelihood of α error
* The type II error or β is used to determine the power of a study.

$$\text{Power} = 1 - \beta$$

* As the sample size (n) increases, the power of the study Increases.
* Power is most Important when designing a study, β is generally greater than α.
* Power is the ability of a statistical test to detect a difference of a specified magnitude given that this difference exists in the populations being compared.
* Power is the probability that a test will reach a particular correct conclusion.

7) Calculation of the Test statistic. (Calculate Test statistic)

From the data contained in the sample we compute a value of the test statistic (Z, t, X^2... etc) and compare it with the acceptance and rejection regions that have been already specified.

8) Statistical Decision. (Make statistical decision)

two statistical Decisions can be made:

a) Reject the Ho: Reject the Ho if the computed value of the test statistic falls in the rejection region.

b) Do not Reject the Ho (Fail to Reject the Ho)
Do not Reject the Ho if the computed value of the test statistic falls in the acceptance region.

9) Conclusion. If Ho is Rejected, we conclude that HA is True.
If Ho is not Rejected, we conclude that Ho may be True.

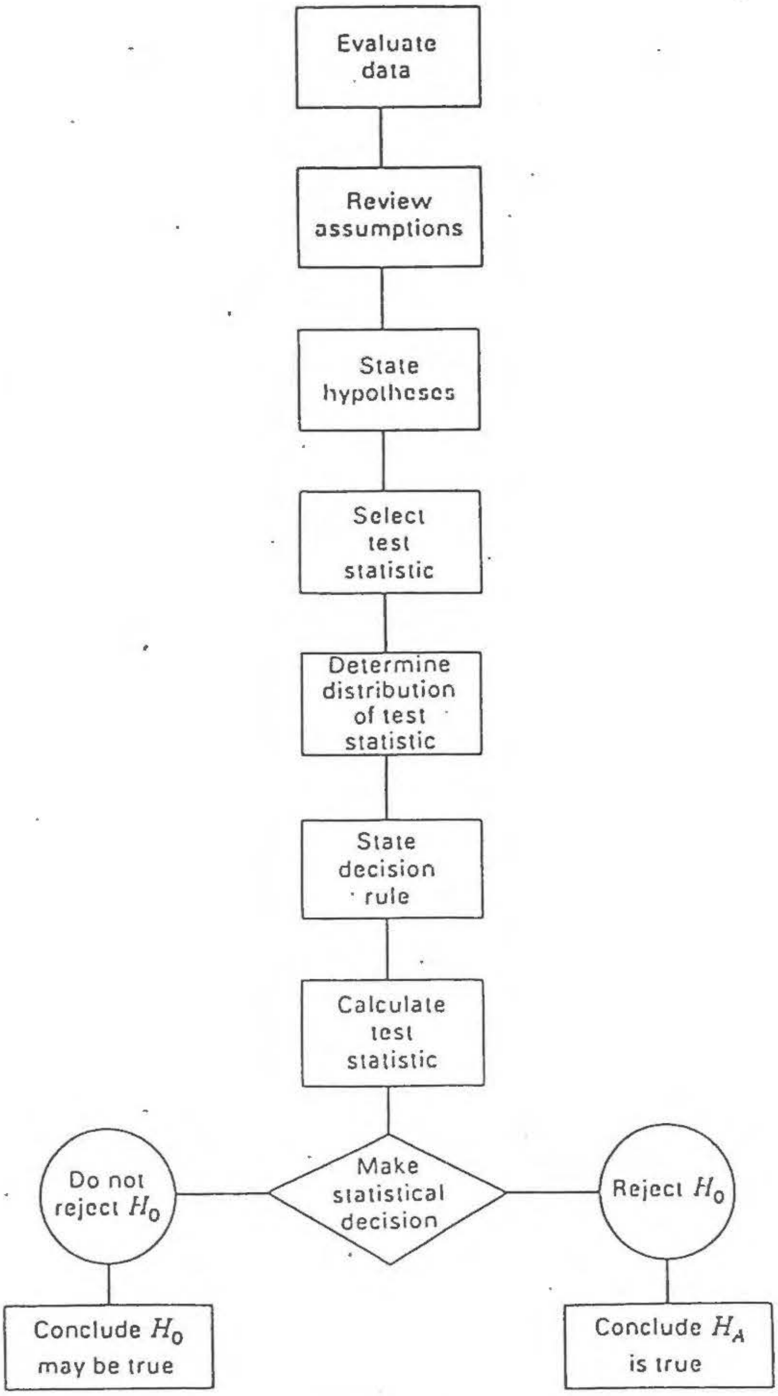

FIGURE 6.1.2

Steps in the Hypothesis Testing Procedure

Standard procedure for Hypothesis Testing

1) State the null hypothesis Ho, and the alternative hypothesis HA.

2) Choose a statistical Test for Testing the Ho.
   e.g. Normal Z, t, χ^2

3) Compute the Value of the Statistical test, using the data obtained from the sample(s).

4) Determine the Significance level of the Statistic and make statistical decisions.

5) Evaluate the evidence against Ho.
   Reject Ho → Conclude that HA is True.
   Do Not Reject → Conclude Ho may be True.

"State the conclusion"

Normal Curve Areas $P(z \le z_0)$ Entries in the Body of the Table are Areas Between $-\infty$ and z

z	−0.09	−0.08	−0.07	−0.06	−0.05	−0.04	−0.03	−0.02	−0.01	0.00	z
−3.80	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	−3.80
−3.70	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	−3.70
−3.60	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0002	.0002	−3.60
−3.50	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	−3.50
−3.40	.0002	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	−3.40
−3.30	.0003	.0004	.0004	.0004	.0004	.0004	.0004	.0005	.0005	.0005	−3.30
−3.20	.0005	.0005	.0005	.0006	.0006	.0006	.0006	.0006	.0007	.0007	−3.20
−3.10	.0007	.0007	.0008	.0008	.0008	.0008	.0009	.0009	.0009	.0010	−3.10
−3.00	.0010	.0010	.0011	.0011	.0011	.0012	.0012	.0013	.0013	.0013	−3.00
−2.90	.0014	.0014	.0015	.0015	.0016	.0016	.0017	.0018	.0018	.0019	−2.90
−2.80	.0019	.0020	.0021	.0021	.0022	.0023	.0023	.0024	.0025	.0026	−2.80
−2.70	.0026	.0027	.0028	.0029	.0030	.0031	.0032	.0033	.0034	.0035	−2.70
−2.60	.0036	.0037	.0038	.0039	.0040	.0041	.0043	.0044	.0045	.0047	−2.60
−2.50	.0048	.0049	.0051	.0052	.0054	.0055	.0057	.0059	.0060	.0062	−2.50
−2.40	.0064	.0066	.0068	.0069	.0071	.0073	.0075	.0078	.0080	.0082	−2.40
−2.30	.0084	.0087	.0089	.0091	.0094	.0096	.0099	.0102	.0104	.0107	−2.30
−2.20	.0110	.0113	.0116	.0119	.0122	.0125	.0129	.0132	.0136	.0139	−2.20
−2.10	.0143	.0146	.0150	.0154	.0158	.0162	.0166	.0170	.0174	.0179	−2.10
−2.00	.0183	.0188	.0192	.0197	.0202	.0207	.0212	.0217	.0222	.0228	−2.00
−1.90	.0233	.0239	.0244	.0250	.0256	.0262	.0268	.0274	.0281	.0287	−1.90
−1.80	.0294	.0301	.0307	.0314	.0322	.0329	.0336	.0344	.0351	.0359	−1.80
−1.70	.0367	.0375	.0384	.0392	.0401	.0409	.0418	.0427	.0436	.0446	−1.70
−1.60	.0455	.0465	.0475	.0485	.0495	.0505	.0516	.0526	.0537	.0548	−1.60
−1.50	.0559	.0571	.0582	.0594	.0606	.0618	.0630	.0643	.0655	.0668	−1.50
−1.40	.0681	.0694	.0708	.0721	.0735	.0749	.0764	.0778	.0793	.0808	−1.40
−1.30	.0823	.0838	.0853	.0869	.0885	.0901	.0918	.0934	.0951	.0968	−1.30
−1.20	.0985	.1003	.1020	.1038	.1056	.1075	.1093	.1112	.1131	.1151	−1.20
−1.10	.1170	.1190	.1210	.1230	.1251	.1271	.1292	.1314	.1335	.1357	−1.10
−1.00	.1379	.1401	.1423	.1446	.1469	.1492	.1515	.1539	.1562	.1587	−1.00
−0.90	.1611	.1635	.1660	.1685	.1711	.1736	.1762	.1788	.1814	.1841	−0.90
−0.80	.1867	.1894	.1922	.1949	.1977	.2005	.2033	.2061	.2090	.2119	−0.80
−0.70	.2148	.2177	.2206	.2236	.2266	.2296	.2327	.2358	.2389	.2420	−0.70
−0.60	.2451	.2483	.2514	.2546	.2578	.2611	.2643	.2676	.2709	.2743	−0.60
−0.50	.2776	.2810	.2843	.2877	.2912	.2946	.2981	.3015	.3050	.3085	−0.50
−0.40	.3121	.3156	.3192	.3228	.3264	.3300	.3336	.3372	.3409	.3446	−0.40
−0.30	.3483	.3520	.3557	.3594	.3632	.3669	.3707	.3745	.3783	.3821	−0.30
−0.20	.3859	.3897	.3936	.3974	.4013	.4052	.4090	.4129	.4168	.4207	−0.20
−0.10	.4247	.4286	.4325	.4364	.4404	.4443	.4483	.4522	.4562	.4602	−0.10
0.00	.4641	.4681	.4721	.4761	.4801	.4840	.4880	.4920	.4960	.5000	0.00

TABLE C (*Continued*)

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	z
0.00	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359	0.00
0.10	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753	0.10
0.20	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141	0.20
0.30	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517	0.30
0.40	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879	0.40
0.50	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224	0.50
0.60	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549	0.60
0.70	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852	0.70
0.80	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133	0.80
0.90	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389	0.90
1.00	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621	1.00
1.10	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830	1.10
1.20	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015	1.20
1.30	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177	1.30
1.40	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319	1.40
1.50	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441	1.50
1.60	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545	1.60
1.70	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633	1.70
1.80	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706	1.80
1.90	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767	1.90
2.00	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817	2.00
2.10	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857	2.10
2.20	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890	2.20
2.30	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916	2.30
2.40	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936	2.40
2.50	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952	2.50
2.60	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964	2.60
2.70	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974	2.70
2.80	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981	2.80
2.90	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986	2.90
3.00	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990	3.00
3.10	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993	3.10
3.20	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995	3.20
3.30	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997	3.30
3.40	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998	3.40
3.50	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	3.50
3.60	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.60
3.70	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.70
3.80	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.80

TABLE C (*Continued*)

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	z
0.00	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359	0.00
0.10	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753	0.10
0.20	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141	0.20
0.30	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517	0.30
0.40	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879	0.40
0.50	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224	0.50
0.60	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549	0.60
0.70	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852	0.70
0.80	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133	0.80
0.90	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389	0.90
1.00	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621	1.00
1.10	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830	1.10
1.20	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015	1.20
1.30	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177	1.30
1.40	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319	1.40
1.50	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441	1.50
1.60	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545	1.60
1.70	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633	1.70
1.80	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706	1.80
1.90	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767	1.90
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2.10	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857	2.10
2.20	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890	2.20
2.30	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916	2.30
2.40	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936	2.40
2.50	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952	2.50
2.60	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964	2.60
2.70	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974	2.70
2.80	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981	2.80
2.90	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986	2.90
3.00	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990	3.00
3.10	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993	3.10
3.20	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995	3.20
3.30	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997	3.30
3.40	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998	3.40
3.50	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	3.50
3.60	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.60
3.70	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.70
3.80	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.80

1) Data: $n_1 = 12$, $\bar{X}_1 = 4.5$ mg/dl (Mongoloid)
$n_2 = 15$, $\bar{X}_2 = 3.4$ mg/dl (Normal)

2) Assumptions: two independent Simple Random Samples each drawn from a normally distributed population with a variance equal to 1.

3) Hypotheses:

$H_0: \mu_1 = \mu_2$

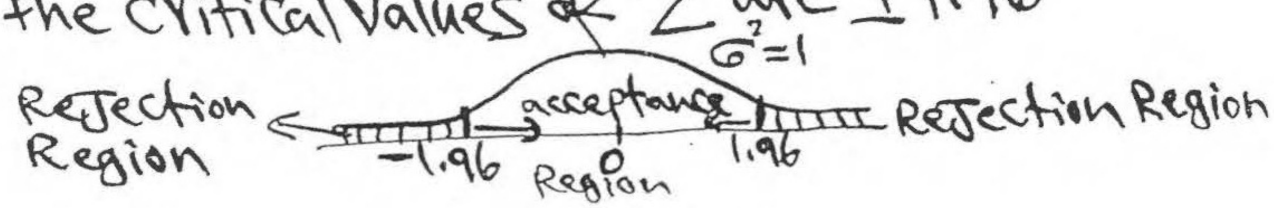
$H_A: \mu_1 \neq \mu_2$

4) Test statistic:

$$Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

5) Distribution of Test Statistic: When the H_0 is true, the test statistic follows the unit normal distribution.

6) Decision Rule: Let $\alpha = 0.05$, from Table C the critical values of Z are ± 1.96



7) Calculation of Test Statistic:

$$Z = \frac{(4.5 - 3.4) - 0}{\sqrt{\frac{1}{12} + \frac{1}{15}}} = \frac{1.1}{0.39} = 2.82$$

8) Statistical Decision: Reject the Ho, Since 2.82 > 1.96

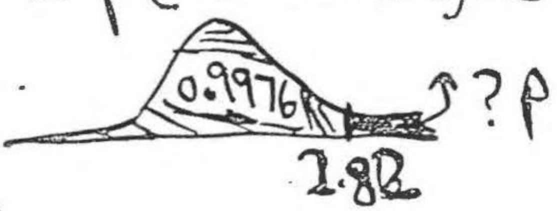
9) Conclusion: Conclude that on the basis of these data, there is an indication that the two population means are not equal.

For this test P value = 0.0048

How do we calculate the p value?

2.82 → from table C = 0.9976

the $P(Z \leq Z_0) = P(Z \leq 2.82) =$ 0.9976



$P = 1 - 0.9976 = 0.0024$

Because the Test is two sided we multiply the P by 2

$P = 0.0024 \times 2 = 0.0048$ which is highly significant

Sampling from a Normally distributed Population: population variance unknown.

The Test statistic for Testing $H_0: \mu = \mu_0$ is

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

Student's-t-test with $(n-1)$ df

Example: Researchers collected serum amylase values from a random sample of 15 apparently healthy subjects. The mean and standard deviation computed from the sample are 96 and 35 units/dl, respectively. They want to know whether they can conclude that the mean of the population from which the sample came is different from 120. (2 sided Test).

1) <u>Data</u>: $n = 15$, $\bar{X} = 96$, $S = 35$ units/dl

2) <u>Assumptions</u>: the data is normally distributed
the population variance is unknown.

3) <u>Hypothesis</u>:

$$H_0: \mu = 120$$
$$H_A: \mu \neq 120$$

4) Test statistic: $$t = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}$$

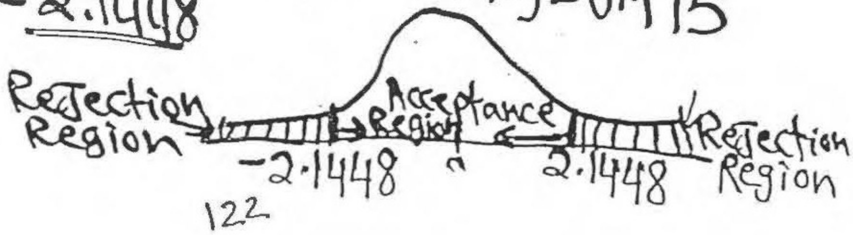
5) <u>Distribution of Test statistic</u>: The test Statistic is distributed as <u>Student's</u> -<u>t</u>- with <u>n-1 df</u> if H_0 is True.

6) <u>Decision Rule</u>: let $\alpha = 0.05$, since we have two-sided test $\frac{\alpha}{2} = 0.025 \Rightarrow$ from Table (t)

$df = 15 - 1 = 14$

t value or critical value $= 2.1448$

$$P(t_{14} \leq 2.1448) = 0.975$$



7) Calculation of Test statistic:

$$t = \frac{96-120}{35/\sqrt{15}} = \frac{-24}{9.04} = -2.65$$

8) Statistical Decision: Reject Ho, Since -2.65 falls in the Rejection region.

9) Conclusion: Based on these data we can conclude that the mean of the population from which the sample came is not 120.

* Sampling from a population that is Not Normally Distributed. (Central Limit theorem)

$$Z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} \quad \text{or} \quad Z = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}$$

Example: In a health survey of a certain community 150 persons were interviewed. The average # of prescriptions each person had had filled during the past year for the 150 persons was 5.8 with S = 3.1. is the population Mean greater than 5? $\mu > 5$? Can we conclude that the $\mu > 5$

(1)

1) **Data**: # prescriptions filled for 150 persons with $\bar{X} = 5.8$, $S = 3.1$

2) **Assumptions**: A random sample from a population that is not normally distributed.

3) **Hypotheses**:

$H_0: \mu \leq 5$

$H_A: \mu > 5$

4) **Test statistic**: $Z = \dfrac{\bar{X} - \mu_0}{S/\sqrt{n}}$

5) **Distribution of Test statistic**: Because of the central Limit Theorem, the test statistic is a proximately normally distributed with $\mu = 0$ if Ho is True.

6) **Decision Rule**: let $\alpha = 0.05 \Rightarrow$ the critical value of the $Z = 1.645$

7) Calculation of Test statistic:

$Z = \dfrac{5.8 - 5.0}{3.1/\sqrt{150}} = \dfrac{0.8}{0.25} = 3.2$

8) Decision: Reject Ho since $3.2 > 1.645$

9) Conclusion: $\mu > 5$

$P = 1 - 0.9993 = 0.0007$

TABLE C (*Continued*)

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	z
0.00	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359	0.00
0.10	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753	0.10
0.20	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141	0.20
0.30	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517	0.30
0.40	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879	0.40
0.50	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224	0.50
0.60	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549	0.60
0.70	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852	0.70
0.80	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133	0.80
0.90	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389	0.90
1.00	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621	1.00
1.10	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830	1.10
1.20	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015	1.20
1.30	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177	1.30
1.40	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319	1.40
1.50	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441	1.50
1.60	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545	1.60
1.70	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633	1.70
1.80	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706	1.80
1.90	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767	1.90
2.00	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817	2.00
2.10	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857	2.10
2.20	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890	2.20
2.30	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916	2.30
2.40	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936	2.40
2.50	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952	2.50
2.60	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964	2.60
2.70	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974	2.70
2.80	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981	2.80
2.90	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986	2.90
3.00	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990	3.00
3.10	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993	3.10
3.20	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995	3.20
3.30	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997	3.30
3.40	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998	3.40
3.50	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	3.50
3.60	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.60
3.70	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.70
3.80	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	3.80