Ex-1 A random sample of 900 members has a mean 3.4 cms. Can it be reasonably regarded as a sample from a large population of mean 3.25 cms and standard deviation 2.61 cms ?

Solⁿ:

Here $n = 900$, $\bar{x} = 3.4$, $\mu = 3.25$, $\sigma = 2.61$

1) Let the null hypothesis H_0: the sample has been drawn from the normal population & S.D.

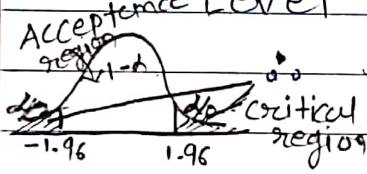
$H_0 : \mu = 3.2.$

$H_1 : \mu \neq 3.25$ (two tailed test).

2) Now $z = \dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \dfrac{3.4 - 3.25}{2.61/\sqrt{900}} = 1.724.$

3) Critical region (Level of significance or p-value)

Level of significance $\alpha = 5\% = 0.05$



∴ By z table.

$z < -1.96$ and $z > 1.96$.

4) Conclusion: H_0 do not reject since.

$-1.96 < 1.724 < 1.96$.

Thus, the sample is drawn from the normal population with mean $\mu = 3.25$ and standard deviation $\sigma = 2.61$.

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EX-2 Let x be the length of a life of certain computer is approximately normally distributed with mean 800 days and standard deviation 40 days. If a random sample of 30 computers has an average life 788 days, test the null hypothesis that $\mu = 800$ days against the alternative hypothesis that $\mu \neq 800$ days at

a) 0.5 % b) 15 % level of significance.

Sol^n: a) 1) Null hypothesis $H_0 : \mu = 800$ days.

& Alternative hypothesis $H_1 : \mu \neq 800$ days.

2) calculation of statistic :

given $\bar{x}$ = mean of sample = 788

n = sample size = 30

σ = standard deviation = 40

$$\therefore z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{788 - 800}{40/\sqrt{30}} = -1.643.$$

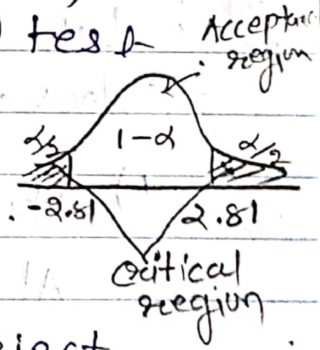
3) Critical region : ($\alpha = 0.5\% = 0.005$)

since H_1 is not equal type,

$\therefore$ the test is two-tailed test

$\therefore$ Critical region is

$z < -2.81$ & $z > 2.81$.



4) Conclusion :

Null hypothesis Ho do not reject.

since

$-2.81 < z = -1.643 < 2.81$

b) step 1 and step 2 remains the same.

3) Critical region (level of significance $\alpha = 15\% = 0.15$)

$$z < -1.44 \quad \& \quad z > 1.44$$

4) Conclusion :

Reject the Null hypothesis Ho since

$$z = -1.643 < -1.44.$$

Ex-3 Sugar is packed in bags by an automatic machine with mean contents of bags as 1.000 kg. A random sample of 36 bags is selected and mean mass has been found to be 1.003 kg. If a S.D of 0.01 kg is acceptable on all the bags being packed, determine on the basis of sample test whether the machine require adjustment. (take level of significance 5%)

Solⁿ; Let the null hypothesis Ho be that the machine does not require any adjustment.

1) Null hypothesis $H_0 : \mu = 1.000$ kg.
Alternative hypothesis $H_1 : \mu \neq 1.000$ kg.

2) Calculation of statistic :

given $\bar{x} = 1.003$ kg, $n = 36$, $\sigma = 0.01$ kg.

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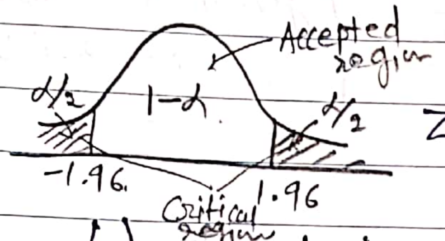
$$\therefore\ Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{1.003 - 1.000}{0.01/\sqrt{36}} = 1.8.$$

3) Critical region : (level of significance $\alpha = 5\% = 0.05$)



$Z < -1.96$ and $Z > 1.96$.

4) Conclusion : Null hypothesis H_0 is not rejected as $-1.96 < z = 1.8 < 1.96$

Thus, we conclude that machine does not required any adjustment.

Ex-4

The target thickness for silicon wafers used in a certain type of integrated circuit is 245 μm. A sample of 50 wafers is obtained and the thickness of each one is determined, resulting in a sample mean thickness of 246.18 μm and a sample standard deviation of 3.60 μm. Does this data suggest that true average wafer thickness is something other than the target value ?

Solⁿ : Let the null hypothesis Ho be that the true average wafer thickness is same as target value.

1) Null hypothesis $H_0: \mu = 245$ μm

Alternative hypothesis $H_1: \mu \neq 245$ μm.

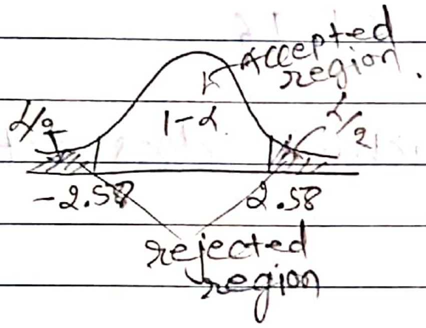
2) Calculation of statistic :

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} = \frac{\bar{X} - \mu}{s/\sqrt{n}}$$ (Large sample $n = 50 > 30$, $\sigma = s$)

$$= \frac{246.18 - 245}{3.60/\sqrt{50}}$$ (given $\bar{X} = 246.18$, $s = 3.60$, $n = 50$)

$$= 2.32$$

3) Critical region : (use significance level $\alpha = 1\% = 0.01$)



.5 - alpha/2

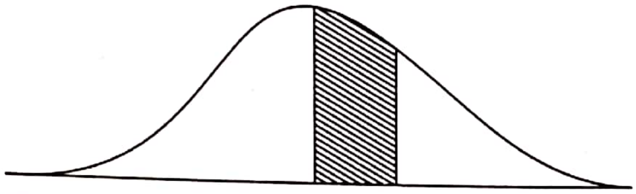
$Z < -2.58$ and $Z > 2.58$.

4) Conclusion : Null hypothesis Ho would not be rejected since

$$-2.58 < 2.32 < 2.58.$$

At the significance level, there is insufficient evidence to conclude that true average thickness differs from the target value.

Table 3. Areas under the Standard Normal Curve from 0 to $\frac{x-\mu}{\sigma}$



t or z	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0745
0.2	0.0793	0.0832	0.0871	0.0910	0.0348	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1808	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2258	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2218	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	0.3023	0.3051	0.3078	03106	0.3133
0.9	03159	0.3186	0.3212	03238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.7418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.1916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	40.4978	0.4879	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986.
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998.	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000