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I. (B). (i) Testing of Significance for equality of means of 2 normal populations with known S.D i.e., Ho: μ1 = μ2; σ1, σ2 are known.

Let x, be the mean of a sample of Size n, from a population with mean μ_i and variance o, and let x2 be the mean of an independent sample of size he from another population with mean μ_2 and Variance σ_2^2 . Then under the null hypothesis $H_0: \mu_1 = \mu_2$ the test statistic will be,

$$Z = \overline{\chi}_1 - \overline{\chi}_2$$

$$\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

Note:

1. If o, and on are not known and of + on, o, and oz can be approximated by the sample S. D's of and of. Hence we have,

$$Z = \frac{\overline{\chi_1} - \overline{\chi_2}}{\sqrt{\frac{{\sigma_1}^2}{n_1} + \frac{{\sigma_2}^2}{n_2}}}$$

 $Z = \overline{\chi_1 - \chi_2}$ (The samples are taken from different Population)



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2. If of and of are equal and not known, then $\sigma_1 = \sigma_2 = \sigma$ is approximated by $\sigma_1^2 = n_1 s_1^2 + n_2 s_2^2$ Hence the test-statistic is given by,

$$Z = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_1}}}$$
The samples are taken from same population

(5) A sample of heights of 6400 Englishmen has a mean of 170 cms and a SD of 6.4 cms, while a sample of heights of 1600 Australians has a mean of 172 cm and a standard deviation of 6.3 cm. Do the data indicate that the Australians are on the average taller than the English men? Solution:

Given: Englishmen -
$$n_1 = 6400$$

$$\overline{x_1} = 170$$

$$S_1 = 6.4 \text{ cm}$$



(An Autonomous Institution)
DEPARTMENT OF MATHEMATICS



(59)

Australians:
$$n_2 = 1600$$

$$\overline{x}_2 = 172$$

$$s_2 = 6.3 \text{ cm}$$

Null hypothesis: Ho: Australians and Englishmen have the same mean height.

Alternative hypothesis: H,: $\mu_a > \mu$, (Right-tailed test)

Level of Significance: At $x = 5 \cdot /.$, $Z_x = 1.645$

Test Statistic:

$$Z = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{5_1^2}{n_1} + \frac{5_2^2}{n_2}}}$$

$$Z = \frac{170 - 172}{\sqrt{\frac{6 \cdot 4^2}{6400} + \frac{6 \cdot 3^2}{1600}}}$$

$$= \frac{-2 \times 40}{\sqrt{40.93}} = -11.3$$

$$121 = 11.3$$

Decision :

Since |z| > 3, Ho is rejected. The data indicate that the Australians are on the average taller than the Englishmen.







Discusses manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 03s with a SD of 12 03s while the corresponding figures in a sample of 400 items from the other process are 124 and 14.

Obtain the standard error of difference between the two sample means. Is this difference Significant?





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Solution :

Given:
$$h_1 = 250$$
, $\overline{\chi}_1 = 120$, $-5_1 = 12$
 $h_2 = 400$, $\overline{\chi}_2 = 124$, $-5_2 = 14$

Null hypothesis: Ho: The sample means do not differ

significantly . i.e., Ho: \mu_1 = \mu_2 .

Alternative hypothesis: $H_1: \mu_1 \neq \mu_2$ (Two-tailed test)

Level of significance: At &= 5%, Zd = 1.96

Standard Error:

S.E
$$(\overline{x}_1 - \overline{x}_2) = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$= \sqrt{\frac{144}{250} + \frac{196}{400}}$$
S.E = 1.034

Test Statistic:

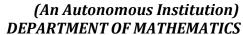
$$Z = \frac{\bar{\chi}_{1} - \bar{\chi}_{2}}{\sqrt{\frac{S_{1}^{2}}{n_{1}} + \frac{S_{2}^{2}}{n_{2}}}}$$

$$= \frac{120 - 124}{1.034}$$

$$= -3.87$$

$$|Z| = 3.87$$







Decision :

Since 121 > 3, Ho is Rejected. Hence we conclude that there is significant difference between the sample means

Test the significance of the difference between the means of the samples, drawn from two normal Populations with the same SD from the following data:

	Size	Mean	S.D
Sample 1	100	61	4
Sample 2	200	63	6

solution:

Given:
$$n_1 = 100$$
, $\overline{\chi}_1 = 61$, $5_1 = 4$
 $n_2 = 200$, $\overline{\chi}_2 = 63$, $5_2 = 6$

Null hypothesis: H_0 : The samples drawn from the two normal populations have the same mean with the Same SD. i.e., H_0 : $\mu_1 = \mu_2$

Alternative hypothesis: H,: μ , $\neq \mu_2$ (Two-tailed test) Level of Significance: At $\alpha = 5$ %, $I_{\alpha} = 1.96$



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Test Statistic:

Decision:

Since 121 > 3, Ho is agjected. Therefore the Samples drawn from the 2 normal populations do not have the same mean though they may have the Same S.D.