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B.COM. PART 1

CORE CONCEPT OF BUSINESS MATHMATICS & STATISTICS

TESTING DIFFERENCE BETWEEN THE MEANS OF TWO SMALL SAMPLES

There may be two objectives of testing difference between means of two small samples-

1) Whether both the samples have been drawn from the same population?
2) Whether the factor affecting both the samples is the same or there is significant difference?

The procedure to be followed for this test is as follows:

1) **Null hypothesis:** First of all, this hypothesis is formulated such that both samples have been drawn from population with the same mean or the two population means do not differ significantly,: $H_0: \bar{x} = \mu_1 = \mu_2$
2) **Test statistic or t-statistic-** Under the assumption that population variances are unknown but equal ($\sigma^2{}_1 = \sigma^2{}_2 = \sigma^2$) for this the following formula is used:

$$t = \frac{I\bar{x}1 - \bar{x}2I}{S\sqrt{(\frac{1}{n1}+\frac{1}{n2})}}, \quad t = \frac{I\bar{x}1 - \bar{x}2I}{S}\sqrt{\frac{n1n2}{n1+n2}}$$

S is computed as follows: $S = \sqrt{\frac{\Sigma(dx1)2+\Sigma(dx2)2}{n1+n2-2}}$

If standard deviations of the samples are given, S will be calculated as follows:

$S = \sqrt{\frac{n1(\sigma2)1+n2(\sigma2)2}{n1+n2-2}}$

3) **Degree of freedom:** degrees of freedom= $n1 + n2 - 2$
4) **Decision:** If calculated value of t is equal to or less than its critical or table value, the null hypothesis is accepted. If calculated value of t is greater than its critical or table value, the null hypothesis is rejected.

Example-39: Two groups of students appeared in a test examination and the marks obtained by them were as follows:

G-1	18	20	36	50	49	36	34	49	41

G-2	29	28	26	35	30	44	46

Examine the significance of difference between mean marks secured by the above two group.

Solution- 39:

Null Hypothesis: There is no significant difference between mean marks by two groups.

$\bar{x} = \sum x/n$ $\qquad$ $\bar{x} = \sum x/n$

$\bar{x} = 333/9 = 37$ $\qquad$ $\bar{x} = 238/7 = 34$

Group 1 ($\bar{x}$=37)			Group 2 ($\bar{x}$=34)		
X_1	dx_1	$(dx_1)^2$	X_2	dx_2	$(dx_2)^2$
18	-19	361	29	-5	25
20	-17	289	28	-6	36
36	-1	1	26	-8	64
50	13	169	35	1	1
49	12	144	30	-4	16
36	-1	1	44	10	100
34	-3	9	46	12	144
49	12	144			
41	4	16			
333	**0**	**1134**	**238**	**0**	**386**

Test Statistics: $S=\sqrt{\frac{\Sigma(dx1)2+\Sigma(dx2)2}{n1+n2-2}}$

$$S=\sqrt{\frac{1134+386}{9+7-2}} = \sqrt{\frac{1520}{14}} = \sqrt{108.57} = 10.42$$

$$t= \frac{I\bar{x}1-\bar{x}2I}{S}\sqrt{\frac{n1n2}{n1+n2}} = \frac{I37-34I}{10.42}\sqrt{\frac{9*7}{9+7}} = \frac{3}{10.42}\sqrt{\frac{63}{16}}$$

$$= \frac{3}{10.42} * 1.984 = 0.571$$

Degree of freedom: $n_1+n_2 = 9+7-2 = 14$

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Decision- The calculated value of t is 0.57, while its table value at 5% level of significance and for 14 d.f. is 2.145. Thus the null hypothesis accepted and there is no significant difference between mean marks secured by two groups.