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SE IT 1 ; S13

Engineering Mathematics - IV
Tutorial - 03

Q. 1

Step 1:
Set up Null and alternative hypothesis H_0 and H_1

$$H_0 : \bar{x} = \mu \qquad H_1 : \bar{x} \neq \mu$$

Step 2:
Let the level of significance be 5% with $n-1 = 10-1 = 9$ degrees of freedom from t-table, tabulated $t_{0.05}$ for $(10-1)$ i.e. 9 d.f = 2.262

Step 3: Test statistic

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

where $\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$ and $S^2 = \frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2$

x	$(x-\bar{x})$ $x - 97.2$	$(x-\bar{x})^2$
70	-27.2	739.84
120	22.8	519.84
110	12.8	163.84
101	3.8	14.44
88	-9.2	84.64
83	-14.2	201.64
95	-2.2	4.84
98	0.8	0.64
107	9.8	96.04
100	2.8	7.84
972		$\sum_{i=1}^{n}(x_i-\bar{x})^2 = 1833.60$

Here $n=10$, $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i = \frac{1}{10}(972) = 97.2$

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i-\bar{x})^2$$

$$= \frac{1}{10-1}(1833.60) = 203.73, \quad s = 14.27$$

$$t = \frac{\bar{x}-\mu}{s/\sqrt{n}} = \frac{972-100}{14.27/\sqrt{10}} = \frac{-2.8}{14.27/3.16} = \frac{-2.8}{4.515} = 0.62$$

$$|t| = 0.62$$

The critical value for t for a two tailed at 5% level of significance with 10-1=9 degrees of freedom is 2.26

Calculated value = 0.62 and Tabulated value = 2.26

|calculated value| ≤ Tabulated value then accept H_0

$|0.62| < 2.26$ accept H_0.

Q4. we first calculate $\bar{X}_1$ and $\bar{X}_2$ etc.

Food A			Food B		
X_1	$d_1 = x_1 - 51$	$d_1^2 = (x_1-51)^2$	X_2	$d_2 = X_2 - 53$	$d_2^2 = (X_2-53)^2$
49	-2	4	52	-1	1
53	2	4	55	2	4
51	0	0	52	-1	1
52	1	1	43	0	0
47	-4	16	50	-3	9
50	-1	1	54	1	1
52	1	1	54	1	1
53	2	4	53	0	0
	-1	31		-1	17

$$\bar{X}_1 = a + \frac{\Sigma d_i}{n} = 51 + \frac{-1}{8} = 50.875$$

$$\Sigma(x_1 - \bar{x})^2 = \Sigma d_1^2 - \frac{(\Sigma d_1)^2}{n} = 31 - \frac{(-1)^3}{8} = 30.875$$

and $$\bar{X}_2 = a + \frac{\Sigma d_i}{n} = 53 - \frac{1}{8} = 52.875$$

$$\Sigma(x_2 - \bar{x})^2 = \Sigma d_2^2 - \frac{(\Sigma d_2)^3}{n} = 17 - \frac{(-1)^3}{8} = 16.875$$

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(i) The null hypothesis $H_0 : \mu_1 = \mu_2$
Alternative hypothesis $H : \mu_1 \neq \mu_2$

(ii) Calculation of test statistic

$$S_p = \sqrt{\frac{\Sigma(X_1-\bar{X}_1)^2 + \Sigma(X_2-\bar{X}_2)^2}{n_1+n_2-2}} = \sqrt{\frac{30.875 + 16.875}{8+8-2}} = \sqrt{3.41}$$

$$S.E. = S_p \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} = \sqrt{3.41} \times \sqrt{\frac{1}{8} + \frac{1}{8}} = 0.92$$

$$\therefore t = \frac{\bar{X}_1 - \bar{X}_2}{S.E.} = \frac{50.875 - 52.875}{0.92} = -2.17$$

$$\therefore |t| = 2.17$$

(iii) Level of significance : $\alpha = 0.05$

(iv) critical value : The value of t at $\alpha = 0.05$ for $\nu = 8+8-2 = 14$ degrees of freedom $= 2.145$

(v) Decision : Since computed value $t = 2.17$ is greater than the table value $t_0 = 2.145$ the level hypothesis is rejected at 5% level of significance

$\therefore$ Food B is ~~greater~~ superior to Food A

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