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Yalcin

Completely Random Design - Independent t - Review problems

Statistics 512
C. T. Gaskins

A. Lots of 10 bees were fed two concentrations of syrup (20% and 65%) at a feeder a half mile from the hive. Upon arrival at the hive their honey sacs were removed and the concentration of fluid was measured. In each case there was a decrease from the feeder concentration. The apiarist wants to know if the decrease in concentration is greater for the 65% syrup than the 20% syrup.

Decrease in Syrup concentration

20%	65%
.7	1.7
.5	2.8
.4	2.2
.7	1.4
.5	1.3
.4	2.1
.7	.8
.4	3.4
.2	1.9
.5	1.4

$n_1 = 10$ $\bar{Y}_1 = .5$ $s_1 = .16$ $\bar{Y}_2 = 1.9$ $s_2 = .77$ $n_2 = 10$

1. Give the null and alternative hypotheses.
$H_0: \mu_1 - \mu_2 = 0$ $H_a: \mu_1 - \mu_2 < 0$

2. Compute the test statistic (t) for testing H_0.
$s_p = \sqrt{\frac{s_1^2 + s_2^2}{2}} = \sqrt{\frac{.16^2 + .77^2}{2}} = .56$
$t = \frac{\bar{y}_1 - \bar{y}_2}{s_p\sqrt{1/n_1 + 1/n_2}} = \frac{.5 - 1.9}{.56\sqrt{1/5}} = -5.59$

3. What critical value should the test statistic be compared to. Give the value and degrees of freedom.
$df = n_1 + n_2 - 2 = 18$ $-t_{.05,18} = -1.734$ $\alpha = .05$

4. Analyze these data using ANOVA

Source	df	SS	MS	F
Total	19	$2.74 + 41.4 - 24^2/20 = 15.34$		
Treatment	1	$\frac{5^2 + 19^2}{10} - 24^2/20 = 9.8$	$9.8/1 = 9.8$	$F = \frac{9.8}{.31} = 31.61$
Error	18	$15.34 - 9.8 = 5.54$	$5.54/18 = .31$	

$F_{.05,1,18} = 4.41$

5. Compare the error degrees of freedom, error mean square and F-ratio from the ANOVA, with the degrees of freedom, error variance and t-value from the independent t analysis.
$df = 1, 8$ (1 numerator, 8 denominator) $EMS = .31$ $F = 31.61$ / $df = 18$ $s = .248$ $t = 5.59$

4. Make a very brief statement interpreting the results of this comparison.

Since $F_{test} = 31.61 > 4.41$ and $t_{test} = 5.65 > 1.734$, We reject Ho and assume the two means are different.

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C. A Study was conducted to evaluate the rates of diffusion of carbon dioxide through two soils of different porosity.

Rates of diffusion	
Fine	Coarse
20	19
31	30
18	32
23	28
23	15
28	26
26	35
27	18
26	25
12	27
17	35
25	34
$\bar{y}_1 = 23$	$\bar{y}_2 = 27$
$s_1 = 5.38$	$s_2 = 6.78$

$n_1 = 12$ $\quad \Sigma y_{1j} = 276$ $\quad n_2 = 12$ $\quad \Sigma y_{2j} = 324$

1. Give the null and alternative hypotheses. $H_0: \mu_1 - \mu_2 = 0$ (2 tailed) $\quad H_a: \mu_1 - \mu_2 \neq 0$

2. Compute the test statistic (t) for testing H_0.

$s_p = 6.12$ $\quad t = \dfrac{\bar{y}_1 - \bar{y}_2}{s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} = \dfrac{23-27}{6.12\sqrt{\frac{2}{12}}} = -1.60$

3. What critical value should the test statistic be compared to. Give the value and degrees of freedom.

$\alpha = .05$ $\quad df = n_1 + n_2 - 2 = 22$ $\quad t_{.025,22} = 2.074$

4. Analyze these data using ANOVA

Source	df	SS	MS	F
Total	23	920		
Treatment	1	96	96/1 = 96	$F = \frac{96}{37.45} = 2.56$
Error	22	824	824/22 = 37.45	

$F_{.05,1,22} = 4.30$

5. Compare the error degrees of freedom, error mean square and F-ratio from the ANOVA, with the degrees of freedom, error variance and t-value from the independent t analysis.

$df = 1, 22$ (1 numerator, 22 denominator) $\quad EMS = 37.45 \quad F = 2.56$ $\quad df = 22 \quad s = 2.5 \quad |t| = 1.60$

4. Make a very brief statement interpreting the results of this comparison.

Since $F_{test} = 2.56 < 4.30$ and $t_{test} = 1.60 < 2.074$, we don't reject H_0 and assume there is no difference between the two means.