Statistics Lab / Assignment - VI

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S1. Let $H_0 \rightarrow$ coaching is not useful

$H_1 \rightarrow$ coaching is useful.

Here, $\nu_1 \rightarrow$ degree of freedom $= n-1 = 10-1 = 9$.

Before	After	d	d^2
24	23	1	1
26	25	1	1
21	21	0	0
22	20	2	4
19	20	-1	1
18	23	-5	25
24	22	2	4
18	19	-1	1
23	21	2	4
22	24	-2	4
		$\Sigma d = -1$	$\Sigma d^2 = 45$

$$\bar{d} = \frac{-1}{10} = -0.1$$

$$s = \sqrt{\frac{\Sigma d^2 - n(\bar{d})^2}{n-1}} = \sqrt{\frac{45 - \left(10 \times \frac{1}{100}\right)}{9}} = 2.23$$

$$\therefore \quad |t_{cal}| = \left| \frac{\bar{d}}{\frac{S}{\sqrt{n-1}}} \right| = \left| \frac{-0.1}{\frac{2.23}{\sqrt{9}}} \right| = 0.134$$

and $\quad t_{0.05} = 1.83$

$$\because \quad |t_{cal}| < t_{0.05},$$

Hence, Ho is accepted and proven that coaching is not useful.

< P.T.O. >

52. Let $H_0 \rightarrow$ two populations have the same variance.

$H_1 \rightarrow$ two populations DO NOT have same variance.

A	$(x_1-\bar{x}_1)$	$(x_1-\bar{x}_1)^2$	B	$(x_2-\bar{x}_2)$	$(x_2-\bar{x}_2)^2$
17	−18.27	333.79	18	−12.22	149.32
19	−16.27	264.71	21	−9.22	85.00
23	−12.27	150.55	25	−5.22	27.24
26	−9.27	85.93	26	−4.22	17.80
29	−6.27	39.31	30	0.22	0.04
34	−1.27	1.61	32	1.78	3.16
41	5.73	32.83	35	4.78	22.84
45	9.73	94.67	39	8.78	77.08
49	13.73	188.51	46	15.78	249.00
51	15.73	247.43	$\Sigma x_2 = 272$	$\Sigma(x_2-\bar{x}_2) = 0.46$	$\Sigma(x_2-\bar{x}_2)^2 = 631.48$
54	18.73	350.81			
$\Sigma x_1 = 388$	$\Sigma(x_1-\bar{x}_1) = 0.03$	$\Sigma(x_1-\bar{x}_1)^2 = 1817.15$			

$\Sigma \bar{x}_2 = \frac{272}{9} = 30.22$

$\Sigma \bar{x}_1 = \frac{388}{11}$

$= 35.27$

Therefore,

$$s_1^2 = \frac{\Sigma(x_1-\bar{x}_1)^2}{\nu} = \frac{1817.15}{10} = 181.715$$

$$s_2^2 = \frac{\Sigma(x_2-\bar{x}_2)^2}{\nu} = \frac{631.48}{8} = 78.935$$

$$F_{cal} = \frac{s_1^2}{s_2^2} = \frac{181.715}{78.935} = 2.302$$

and $F_{0.05} = 3.3472$

$\because$ $F_{0.05} > F_{cal}$,

Hence, Ho is accepted and hence proven that the population have same variance.

< P.T.O. >

S3.

Year	No. of accidents occurred
2008	164
2009	142
2010	153
2011	171
2012	171
2013	148
2014	136
2015	133
2016	138
2017	132
2018	145
2019	124

Let's consider null hypothesis on the basis of the data provided:

$H_0 \longrightarrow$ No. of accidents DO NOT differ significantly.

$H_1 \longrightarrow$ No. of accidents DO differ significantly.

ν (degree of freedom) $= 12-1 = 11$

LOS $=$ 0.05 [given]

$$\therefore E_i = \frac{164 + 142 + 153 + 171 + 171 + 148 + 136 + 133 + 138 + 132 + 145 + 124}{12}$$

$= 146.416$

Year	O_i	E_i	$O_i - E_i$	$(O_i-E_i)^2$	$\frac{(O_i-E_i)^2}{E_i}$
2008	164	146.416	17.584	309.197	2.11
2009	142	146.416	-4.416	19.501	0.13
2010	153	146.416	6.584	43.34	0.29
2011	171	146.416	24.584	604.37	4.12
2012	171	146.416	24.584	604.37	4.12
2013	148	146.416	1.584	2.50	0.01
2014	136	146.416	-10.416	108.49	0.74
2015	133	146.416	-13.416	179.98	1.22
2016	138	146.416	-8.416	70.82	0.48
2017	132	146.416	-14.416	207.82	1.41
2018	145	146.416	-1.416	2.00	0.01
2019	124	146.416	-22.416	502.47	3.43

$$\chi^2_{cal} = 18.07$$

$$\therefore \chi^2_{table\,(\alpha=0.05,\ \nu=11)} = 19.675$$

$\because \chi^2_{cal} < \chi^2_{table}$, $\therefore$ Ho will be accepted.

Hence, we can conclude that the number of accidents DO NOT differ significantly.