

MATHEMATICS 201-510-LW

Business Statistics

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XXVII – Inferences for Correlation

1. Some students claim they can tell the cost of a textbook just by looking at its thickness. To test this claim they picked four hardbound books of the same height and width at random. The cost and thickness for each book was:

x (Thickness in cm)	1.3	3.5	2.6	4.1
y (Cost in \$)	72	88	65	105

- a) Construct a 95% confidence interval for the population correlation.
b) Determine if the correlation is significant at the 5% level of significance. Try with both approaches, the classical and the p -value.
2. Do reading and TV viewing compete for leisure time? To find out, a communication specialist interviewed a sample of children regarding the number of books they had read during the last year and the number of hours they had spent watching TV on a daily basis.

Daily Hours of TV Viewing	Yearly Number of Books Read
3	0
1	7
2	2
2	1
0	5
1	4
3	3
2	3
7	0
4	1

- a) Construct a 99% confidence interval for the population correlation.
b) Determine if the correlation is significant at the 1% level of significance. Try with both approaches, the classical and the p -value.

3. Eight people applying for a job as a graphic designer were given two tests, one measuring the applicant's logical reasoning ability (on a scale of 1 to 20), the other measuring the applicant's creativity (on a scale of 1 to 30). Here are the results

Reason (scale 1 to 20)	Creativity (scale 1 to 30)
13	18
13	20
18	31
14	25
9	23
9	21
5	5
10	21

- a) Construct a 90% confidence interval for the population correlation.
 b) Determine if the correlation is significant at the 10% level of significance. Try with both approaches, the classical and the p -value.
4. A company wants to explore the relationship between its annual advertising spending x (in \$1000) and its annual sales y (in \$1000). A random sample of 25 weeks was taken, and the following results were calculated.

$$SS_x = 3.819 \quad SS_y = 6434 \quad SS_{xy} = 156.5 \quad \bar{x} = 1.440 \quad \bar{y} = 57.69$$

- a) Construct a 95% confidence interval for the population correlation.
 b) Determine if the correlation is significant at the 5% level of significance. Try with both approaches, the classical and the p -value.
5. An article in the *Journal of Social Psychology* reported a linear correlation coefficient of -0.61 between satisfaction with work scores and propensity to leave a job. Suppose this was based on a random sample of 250 Canadian adults.
- c) Construct a 99% confidence interval for the population correlation.
 d) Determine if the correlation is significant at the 1% level of significance. Try with both approaches, the classical and the p -value.
6. The following is a correlation matrix among family size, weekly grocery bill, and income for a random sample of 50 families.

	Family size	Weekly grocery bill	Income
Family size	1.00	0.60	0.20
Weekly grocery bill		1.00	0.30
Income			1.00

Which of the correlations are significant at the 5% level of significance? Use the classical approach.

ANSWERS

1. a) $-0.691 < \rho < 0.996$
 b) $H_o : \rho = 0$ critical values: $\pm t_{(2,0.05)} = \pm 4.303$ Fail to reject H_o
 $H_A : \rho \neq 0$ test statistic: $t = 1.91$
 $0.184 < p\text{-value} < 0.198$
2. a) $-0.956 < \rho < 0.057$
 b) $H_o : \rho = 0$ critical values: $\pm t_{(8,0.005)} = \pm 3.335$ Fail to reject H_o
 $H_A : \rho \neq 0$ test statistic: $t = -2.98$
 $0.018 < p\text{-value} < 0.020$
3. a) $0.386 < \rho < 0.954$
 b) $H_o : \rho = 0$ critical values: $\pm t_{(6,0.05)} = \pm 1.943$ Fail to reject H_o
 $H_A : \rho \neq 0$ test statistic: $t = 3.45$
 $0.012 < p\text{-value} < 0.014$
4. a) $0.9963 < \rho < 0.9993$
 b) $H_o : \rho = 0$ critical values: $\pm t_{(23,0.025)} = \pm 2.069$ Reject H_o
 $H_A : \rho \neq 0$ test statistic: $t = 84.68$
 $p\text{-value} = 0.000$
5. a) $-0.703 < \rho < -0.497$
 c) $H_o : \rho = 0$ critical values: $\pm t_{(248,0.005)} = \pm 2.617$ Reject H_o
 $H_A : \rho \neq 0$ test statistic: $t = -12.12$
 $p\text{-value} = 0.000$
6. a) $H_o : \rho_{fw} = 0$ critical values: $\pm t_{(48,0.025)} = \pm 2.009$ Reject H_o
 $H_A : \rho_{fw} \neq 0$ test statistic: $t = 5.20$
 $p\text{-value} < 0.002$
 b) $H_o : \rho_{fi} = 0$ critical values: $\pm t_{(48,0.025)} = \pm 2.009$ Fail to reject H_o
 $H_A : \rho_{fi} \neq 0$ test statistic: $t = 1.41$
 $0.140 < p\text{-value} < 0.168$
 c) $H_o : \rho_{wi} = 0$ critical values: $\pm t_{(48,0.025)} = \pm 2.009$ Fail to reject H_o
 $H_A : \rho_{wi} \neq 0$ test statistic: $t = 2.18$
 $0.032 < p\text{-value} < 0.042$

Thus the correlations that are significant are between family size and weakly grocery bill and between weakly grocery bill and income.