MATHEMATICS 201-510-LW
Business Statistics
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XXVI – Inferences for Regression

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) Find the equation of the least-squares line.
   b) Find a 95% confidence interval for the y-intercept α of the regression line.
   c) Find a 95% confidence interval for the slope β of the regression line.
   d) Determine if the y-intercept α of the regression line is less than 100 at the 5% level of significance. Try with both approaches, the classical and the p-value.
   e) Determine if the slope β of the regression line is positive at 5% level of significance. Try with both approaches, the classical and the p-value.
   f) If a book has a thickness of 2.2 cm, find a 95% confidence interval for the predicted cost.

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) Find the equation of the least-squares line.
   b) Find a 99% confidence interval for the y-intercept α of the regression line.
   c) Find a 99% confidence interval for the slope β of the regression line.

d) Determine if the *y*-intercept α of the regression line is positive at the 1% level of significance. Try with both approaches, the classical and the *p*-value.
e) Determine if the slope β of the regression line is negative at 1% level of significance. Try with both approaches, the classical and the *p*-value.
f) If a child watches 2 hours of television per day, a 99% confidence interval for the predicted yearly number of books read.

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) Find the equation of the least-squares line.
b) Find a 95% confidence interval for the *y*-intercept α of the regression line.
c) Find a 95% confidence interval for the slope β of the regression line.
d) Determine if the *y*-intercept α of the regression line is different than 5 at the 10% level of significance. Try with both approaches, the classical and the *p*-value.
e) Determine if the slope β of the regression line is different than zero at the 10% level of significance. Try with both approaches, the classical and the *p*-value.
f) If a person scores 12 on reason, find a 90% confidence interval for the predicted score in creativity.

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.

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

a) Find the equation of the least-squares line.
b) Find a 95% confidence interval for the *y*-intercept α of the regression line.
c) Find a 95% confidence interval for the slope β of the regression line.
d) Determine if the *y*-intercept α of the regression line is different than 0 at the 5% level of significance. Try with both approaches, the classical and the *p*-value.
e) Determine if the slope β of the regression line is greater than 40 at the 5% level of significance. Try with both approaches, the classical and the *p*-value.
f) If the amount spent on advertising is \$2000, find a 95% confidence interval for the predicted sales.

ANSWERS

1. a) $y = 48.66 + 11.77x$ b) -32.42 to 129.74 c) -14.71 to 38.25.

   d) $H_o: \alpha = 100$ critical values: $t_{(df,1-\alpha)} = -2.920$ Reject H_o

   $H_a: \alpha < 100$ test statistic: $t = -2.72$

   $0.054 < p - \text{value} < 0.057$

   e) $H_o: \beta = 0$ critical values: $t_{(2,0.05)} = 2.920$ Fail to reject H_o

   $H_A: \beta > 0$ test statistic: $t = 1.91$

   $0.092 < p - \text{value} < 0.099$

   f) \$9.62 to \$139.48

2. a) $y = 4.701 - 0.841x$ b) 1.749 to 7.653 c) -1.788 to 0.107

   d) $H_o: \alpha = 0$ critical values: $t_{(df,\alpha)} = 2.896$ Reject H_o

   $H_a: \alpha > 0$ test statistic: $t = 5.34$

   $p - \text{value} < 0.002$

   e) $H_o: \beta = 0$ critical values: $t_{(df,1-\alpha)} = -2.896$ Reject H_o

   $H_a: \beta < 0$ test statistic: $t = -2.98$

   $0.009 < p - \text{value} < 0.010$

   f) 0 to 8.878 books.

3. a) $y = 3.159 + 1.524x$ b) -7.111 to 13.429 c) 0.666 to 2.383

   d) $H_o: \alpha = 5$ critical values: $\pm t_{(df,\frac{\alpha}{2})} = \pm 1.943$ Fail to reject H_o

   $H_a: \alpha \neq 5$ test statistic: $t = -0.35$

   $0.704 < p - \text{value} < 0.774$

   e) $H_o: \beta = 0$ critical values: $\pm t_{(df,\frac{\alpha}{2})} = \pm 1.943$ Reject H_o

   $H_a: \beta \neq 0$ test statistic: $t = 3.45$

   $0.012 < p - \text{value} < 0.014$

   f) 11.89 to 30

4. a) $y = -1.321 + 40.98x$ b) -2.281 to 0.179 c) 39.97 to 41.99

   d) $H_o: \alpha = 0$ critical values: $\pm t_{(df,\frac{\alpha}{2})} = \pm 2.069$ Fail to reject H_o

   $H_a: \alpha \neq 0$ test statistic: $t = -1.82$

   $0.070 < p - \text{value} < 0.083$

   e) $H_o: \beta = 40$ critical values: $t_{(df,\alpha)} = 1.714$ Reject H_o

   $H_a: \beta > 40$ test statistic: $t = 2.02$

   $0.012 < p - \text{value} < 0.014$

   f) \$78 558 to \$82 720.