Statistics (2) Quiz-4

Date: Jun, 12, 2018

Name :

ID :

1. A Two-Way ANOVA Summary Table is shown below and some values are missed. ($\alpha = 0.05$)

a. What are factors and factor levels?
b. What are the hypotheses?
c. What is the critical values for each of the hypotheses?
d. Finish the ANOVA table and make a conclusion.

Source	SS	d.f.	MS	F
Factor A	11.9	2	5.95	4.25
Factor B	3.7	2	1.85	1.32
Interaction	37.8	4	9.45	6.75
Within	75.6	54	1.4	
Total	129.0	62		

a. Factor A : 3 levels

Factor B : 3 levels.

b. ① H_0: Factor A 無顯著效果
H_1: " 有 "

② H_0: " B 無 "
H_1: " B 有 "

③ H_0: Factor A & B 無交互作用
H_1: " 有

⇒ Facto

CV. $F(2,54) = 3.18$ test value 4.25 ⇒ rej. H_0

⇒ Factor A 效果顯著

$F(2,54) = 3.18$ 1.32 ⇒ do not rej. H_0

⇒ Factor B 效果不顯著

$F(4,54) = 2.56$ 6.75 ⇒ rej. H_0

⇒ AB 有交互作用

2. The demand for a product (in hundreds) and its price (in dollars) charged in nine different cities are collected.

Price	23	19	23	21	22	25	35	15	30
Demand	17	48	35	42	30	28	15	52	18

a. Draw the scatter plot for the data.
b. What is the relationship between the price and its demand?
c. Test the significance of the correlation coefficient at $\alpha = 0.01$.
d. The table of regression analysis is shown below. What is the equation of the regression line? $y' = 78.49 - 1.98x$
e. Put the regression line on the scatter plot.
f. What percentage of variation is explained by the regression line? (coefficient of determination) $r^2 = 72.8\%$
g. If there is a significant relationship, predict the demand of the product when the price is 28.

b. 負相關.

c. ① H_0: $\rho = 0$
H_1: $\rho \neq 0$

② $\alpha = 0.01 \Rightarrow t_{(7)} = 3.499$

③ test value:

$t = r\sqrt{\frac{n-2}{1-r^2}} = 4.327$

④ ∵ test value > C.V.

⇒ reject H_0.

⑤ ⇒ Price & demand are related significantly.

g. $y'_{x=28} = 78.49 - 1.98 \times 28 = 23.05$

Regression statistics	
Multiple R	0.853
R Square	0.728
Adjusted R Square	0.690
Standard Error	7.615
Observations	9

	Coefficient	Stand. Error	T Stat.	P-value	Lower 95%	Upper 95%
Intercept	78.49	11.10	7.07	0.00	52.24	104.74
Price	-1.98	0.46	-4.33	0.00	-3.06	-0.90

3. The following data list ages of cars (in years) and monthly repair cost in dollars. $n=6$.

age	3	5	7	9	10	14
cost	25	35	55	50	75	85

a. What is the correlation coefficient?
b. What is the regression line equation?

8% × 3

a. $r = 0.952$ =

5% × 5 $\Sigma x = 48$ $\Sigma y = 325$ $\Sigma xy = 3025$

2%

$\Sigma x^2 = 460$. $\Sigma y^2 = 20225$

1%

$S_{xx} = \Sigma x^2 - n\bar{x}^2$

$S_{yy} = \Sigma y^2 - n\bar{y}^2 =$

$S_{xy} = \Sigma xy - n\bar{x}\bar{y} =$

b. $y' = a + bx$

$a = 9.430$

$b = 5.592$

$\Rightarrow y' = 9.43 + 5.92x$

5.92%

4. A researcher desires to know if the age of a child is related to the number of cavities he or she has. $n=6$. $\bar{x}=10$.

age x	6	8	9	10	13	14
cavities	2	1	3	4	6	5

a. The equation of the regression line is $y = -1.93 + 0.54\,x$, predict the number of cavities of a twelve -year-old child.
b. What is the standard error of the estimation?
c. Find the 95% prediction interval for the number of cavities of a twelve-year-old child.

1.31 2.39 2.93 3.47 5.09 5.63

y' 0.77 2.12 3.92

1.67 2.57 4.37

a. $y' = -1.93 + 0.54 \times 12 = 4.55$.

b. $S_{est} = \sqrt{\frac{\Sigma(y-y')^2}{n-2}} = \sqrt{\frac{\Sigma y^2 - a\Sigma y - b\Sigma xy}{4}}$

$\Sigma y^2 = 91$

$\Sigma xy = 335$

$\Sigma y = 21$

$= 0.989$ 1.076

c. $y' \pm t_{(4)} \cdot S_{est} \times \sqrt{1 + \frac{1}{n} + \frac{(x_0-\bar{x})^2}{\Sigma(x-\bar{x})^2}}$

$4.55 \pm 2.776 \times 1.076 \times \sqrt{1 + \frac{1}{6} + \frac{(12-10)^2}{46}}$

$\Rightarrow (1.506, 7.894)$