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Matuk : Statistika Modeling

Pertemuan ke-7

Soal

1. Apakah semakin besar biaya iklan yang dikeluarkan akan semakin besar pula profit yang diperoleh? Diamati contoh acak 10 perusahaan yang memproduksi Handphone, kemudian dicatat pengeluaran iklan (dalam milyar) dan profit (dalam milyar) selama tahun 2017.

| | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Iklan | 31 | 38 | 48 | 52 | 63 | 67 | 75 | 84 | 89 | 99 |
| Profit | 553 | 590 | 608 | 682 | 752 | 725 | 834 | 752 | 845 | 960 |

- a. Buat scatter plot dan

Jawab :



- b. Tentukan persamaan model

regresinya Jawab :

$$\text{Model : } Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i ; i = 1, 2, \dots, n$$

- c. Tentukan penduga bagi parameter model regresi tersebut Jawab :

| x | y | x ² | y ² | xy |
|--------|-----|----------------|----------------|-----------|
| 31 | 553 | 961 | 305.809 | 17.143 |
| 38 | 590 | 1.444 | 348.100 | 22.420 |
| 48 | 608 | 2.304 | 369.664 | 29.184 |
| 52 | 682 | 2.704 | 465.124 | 35.464 |
| 63 | 752 | 3.969 | 565.504 | 47.376 |
| 67 | 725 | 4.489 | 525.625 | 48.575 |
| 75 | 834 | 5.625 | 695.556 | 62.550 |
| 84 | 752 | 7.056 | 565.504 | 63.168 |
| 89 | 845 | 7.921 | 714.025 | 75.205 |
| 99 | 960 | 9.801 | 921.600 | 95.040 |
| Jumlah | 646 | 7.301 | 46.274 | 5.746.511 |

$$\begin{aligned}
 b_1 &= \frac{\sum xy}{\sum x^2} = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}} \\
 &= \frac{496.125 - \frac{(646)(7.301)}{11}}{46.274 - \frac{(646)^2}{11}} \\
 &= \frac{24.680,4}{9.542,4} = 2,59
 \end{aligned}$$

$$\begin{aligned}
 b_0 &= \bar{y} - b_1 \bar{x} \\
 &= 730,1 - 2,59 \cdot 64,55 \\
 &= 381,95
 \end{aligned}$$

- d. Apakah iklan berpengaruh pada profit perusahaan? Uji hipotesis anda pada taraf nyata $\alpha = 0,05$

Jawab :

Handwritten calculations for a hypothesis test:

$$H_0: \beta = 0$$
$$H_1: \beta \neq 0$$

a)
$$SSE = \sum (y_i - \bar{y}_0 - \bar{\beta}_1 x_i)^2$$
$$= \sum y_i^2 - \frac{(\sum x_i y_i)^2}{\sum x_i^2} = 14,118.45$$

b)
$$s^2 = \frac{SSE}{n-2} = \frac{14,118.45}{8} = 1,764.81$$

c)
$$s_{b_1} = \sqrt{\frac{s^2}{\sum (x_i - \bar{x})^2}}$$
$$= \sqrt{\left(\frac{s^2}{\sum x_i^2} \right)} = \sqrt{\frac{1,764.81}{4,542.4}} = 0,263$$

d)
$$t_{hitung} = \frac{b_1 - \beta_1}{s_{b_1}} = \frac{b_1 - 0}{s_{b_1}} = \frac{5,39}{0,263} = 8,64$$

$$t(\alpha/2; db = n-2) = t(0,025; 8) = 2,306$$

Karena $(t_{hit} = 8.64) > 2.306$ maka H_0 ditolak, artinya iklan berpengaruh pada profit perusahaan untuk taraf uji $\alpha = 0.05$

- e. Apakah semakin besar iklan akan mengakibatkan semakin besar profit? Uji pada taraf nyata $\alpha = 0,05$

Jawab :

Handwritten calculations for a hypothesis test on the slope of a regression line:

$$\begin{aligned} H_0: \beta_1 &= 0 \\ H_1: \beta_1 &> 0 \\ a) SSE &= \sum (y_i - \bar{y}_0 - \bar{\beta}_1 x_i)^2 \\ &= S_{yy} - \frac{S^2_{xy}}{S_{xx}} = 14.118,45 \\ b) S^2 &= \frac{SSE}{n-2} = \frac{1.764,81}{8} \\ c) S_{b_1} &= \sqrt{\frac{S^2}{\sum (x_i - \bar{x})^2}} \\ &= \sqrt{\left(\frac{S^2}{S_{xx}}\right)} = \sqrt{\frac{1.764,81}{4.542,4}} \\ &= 0,623 \\ d) t\text{-hitung} &= \frac{b_1 - \beta_1}{S_{b_1}} = \frac{b_1 - 0}{S_{b_1}} \\ &= \frac{5,39}{0,623} = 8,64 \\ t(a: db = n-2) &= t(0,05: 8) = 1,860 \end{aligned}$$

Karena $(t\text{-hit} = 8.64) > 1.860$ maka H_0 ditolak, artinya semakin besar iklan akan mengakibatkan semakin besar profit untuk taraf uji $\alpha = 0.05$