16/ENG01/019

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Assignment VI

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Electrical/Electronics

Solution

Given $d = \alpha\beta^{b}$.

Comparing the equation he

$y = mx + c$.

$\log d = \log\alpha + \log\beta$

where $a_0 = \log\alpha$

$a_1 = \log\beta$

t=x t(hr)	d(m)	$Y = \log d$	xY	x^2	Y^2
0	2	0.301029996	0	0	0.09061905
1	5	0.698970004	0.698970004	1	0.488559067
2	19	1.278753601	2.557507202	4	1.635210972
3	50	1.698970004	5.096910013	9	2.886499076
4	151	2.178976947	8.715907789	16	4.747940537
5	470	2.672097858	13.36048929	25	7.140106962
6	1435	3.156851091	18.94111141	36	9.965713925
7	4512	3.654369091	25.58058364	49	13.35441345
8	12936	4.111800007	32.89440006	64	16.90689933
9	41125	4.614165911	41.52749320	81	21.28997336
10	111021	5.045405135	50.45405135	100	25.45611297
Σx		ΣY	ΣxY	Σx^2	ΣY^2
55		29.41133046	199.8268839	385	103.9620485

$\Sigma y = a_0 n + a_1 \Sigma x$

$29.41133046 = a_0(11) + a_1(55) \quad \ldots (1)$

$\Sigma xy = a_0 \Sigma x_i + a_1 \Sigma x^2$

$199.8268839 = a_0(55) + a_1(385) \quad \ldots (2)$

Solving Equations 1 and 2

$29.41133046 = 11a_0 + 55a_1$

$199.8268839 = 55a_0 + 385a_1$

$$a_0 = \frac{\begin{vmatrix} 29.41133046 & 55 \\ 199.8368839 & 385 \end{vmatrix}}{\begin{vmatrix} 11 & 55 \\ 55 & 385 \end{vmatrix}}$$

$$= \frac{(29.4113046)(385) - (55)(199.8868839)}{(11 \times 385) - (55 \times 55)}$$

$a_0 = 0.27511.$

$$a_1 = \frac{\begin{vmatrix} 11 & 29.41133046 \\ 55 & 199.8268835 \end{vmatrix}}{\begin{vmatrix} 11 & 55 \\ 55 & 385 \end{vmatrix}}$$

$$\therefore \frac{(11 \times 199.8268835) - (29.41130476 \times 55)}{(11 \times 385) - (55 \times 55)}$$

$a_1 = 0.47973.$

$a_0 = \log \alpha$

$0.27511 = \log \alpha$

$\alpha = 10^{0.27511}$

$\alpha = 1.884126$

$a_1 = \log \beta$

$0.47973 = \log \beta$

$\beta = 10^{0.47973}$

$\beta = 3.018074$

$\alpha = 1.8841$

$\beta = 3.0181$

∴ The values of α and β are 1.8841 and 3.0181 respectively

Correlation coefficient

$$R = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[N\Sigma x^2 - (\Sigma x)^2][N\Sigma y^2 - (\Sigma y)^2]}}$$

$$R = \frac{(11 \times 199.8268839) - (55 \times 29.41133048)}{\sqrt{[(11 \times 385.55) - (55)^2] \times [(11 \times 103.9600\ 43) - (29.41133048)^2]}}$$

$$R = 0.999844\ 8312$$

$$R_{square} = (0.999844\ 8312)^2$$

$$= 0.9996896865$$

(b) For manual method

$R = 0.999844\ 8312$

~~$R^2 = 0.9998446$~~

$R^2 = 0.9996896864$

For matlab

$R = 0.998$

$R^2 = 0.997$

For excel

$R = 0.999844\ 83235763$

$R^2 = 0.999689\ 188791\ 2257$

(a) The comments on the results obtained showed that for all the methods used to solve the correlation coefficient and the square of it, it was observed that ($r^2 < R$). The value of the source of the correlation coefficient is lesser than the actual value of the correlation coefficient.