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MECHANICAL ENGINEERING
16/ENG06/028
ENG 382 . ASSIGNMENT 6

SOLUTION.

Given $d = \alpha\beta^{t}$ - - - - - (i)

Comparing eqn (i) to $y = mx + c$.

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

where;

$a_0 = \log\alpha$.

$a_1 = \log\beta$.

	Y = Log d	t = x	xY	d(m)	x^2	Y^2
1.	0.301029996	0	0	0	0	0.09061905
2.	0.698970004	1	0.698970004	1	1	0.488559067
3.	1.278753601	2	2.557507202	2	4	1.635210772
4.	1.698970004	3	5.096910013	3	9	2.886499076
5.	2.178976947	4	8.715907789	4	16	4.747940537
6.	2.672097858	5	13.36048929	5	25	7.140106982
7.	3.156851907	6	18.9411141	6	36	9.965713925
8.	3.654369091	7	25.58058304	7	49	13.35441345
9.	4.111800007	8	32.89440006	8	64	16.9068993
10.	4.614165911	9	41.5269532	9	81	21.28992336
11.	5.045405135	10	50.45405135	10	100	25.45611297

$\sum x = 55$

$\sum Y = 29.41133046$

$\sum xY = 199.8268839$

$\sum x^2 = 385$

$\sum Y^2 = 103.9620485$

$$\sum Y = a_0 N + a_1 \sum x$$

$$29.41133046 = a_0(11) + a_1(55) - - - - - (i).$$

$$\sum xY = a_0 \sum x_i + a_1 \sum x^2$$

$$199.8268839 = a_0(55) + a_1(385) - - - (ii)$$

Solving eqn (i) & (ii)

$29.41133046 = 11a_0 + 55a_1$

$199.8268839 = 55a_0 + 385a_1$

Using Cramer's rule,

$$a_0 = \frac{\begin{vmatrix} 29.41133046 & 55 \\ 199.8268839 & 385 \end{vmatrix}}{\begin{vmatrix} 11 & 55 \\ 55 & 385 \end{vmatrix}}$$

$$a_0 = \frac{(29.41133046)(385) - (55)(199.8268839)}{(11)(385) - (55)(55)}$$

$a_0 = 0.27511.$

$$a_1 = \frac{\begin{vmatrix} 11 & 29.41133046 \\ 55 & 199.8268839 \end{vmatrix}}{\begin{vmatrix} 11 & 55 \\ 55 & 385 \end{vmatrix}}$$

$$a_1 = \frac{(11)(199.8268839) - (29.41133046)(55)}{(11)(385) - (55)(55)}$$

$a_1 = 0.42973.$

Recall that;

$a_0 = \log \alpha$

$0.27511 = \log \alpha.$

$\alpha = 1.8841.$

$a_1 = \log \beta$

$0.47973 = \log \beta$

$\beta = 3.0181$

Therefore;

$\alpha = 1.8841$

$\beta = 3.0181.$

d) Correlation coefficient

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

$$R = \frac{(11 \times 199.8268839) - (55)(29.44133046)}{\sqrt{((11 \times 385) - 55^2)(11 \times 103.9620485 - (29.44133046)^2)}}$$

$R = 0.999844831 2$.

$R_{square} = (0.9998448312)^2$

$= 0.9996896864$.

Manual Method

$R = 0.9998448312$

$R^2 = 0.9996896864$.

Matlab

$R = 0.9998$

$R^2 = 0.9997$.

Excel

$R = 0.999844832835763$

$R^2 = 0.99968968879 2252$.

e) From Observation for all the methods used to solve the correlation coefficient and its square, it can be seen that $R^2 < R$ (i.e the value of the square of the correlation coefficient is lesser than the actual value of the correlation co-efficient.