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Mechanical Engineering
Eng 382

Given $d = \alpha \beta^t$ ---(1)

Comparing eqn (1) 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	0.090618905
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	7.140106962
7	3.156851909	6	18.94111141	6	36	9.965713925
8	3.654369091	7	25.58058364	7	49	13.35441345
9	4.111800007	8	32.89440006	8	64	16.90689993
10	4.614163911	9	41.52569532	9	81	21.28997336
11	5.045405135	10	50.45405135	10	100	25.45611397

$\Sigma Y = 29.41133046$

$\Sigma x = 55$

$\Sigma xY = 199.8268839$

$\Sigma x^2 = 385$

$\Sigma Y^2 = 103.9620485$

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

$29.41133046 = a_0 (11) + a_1 (55)$ ---(1)

$\sum y = a_0 \sum 1 + a_1 \sum x$

$199.8268839 = a_0(55) + a_1(385) \quad \text{---} \rightarrow$

Saving eqn I and II

$29.41133046 = 11a_0 + 55a_1$

$199.8268839 = 55a_0 + 385a_1$

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

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

$a_0 = 0.27511$

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

$$= \frac{a_1 (11 \times 199.8268835) - (29.41133046 \times 55)}{(11 \times 385) - (55 \times 55)}$$

$a_1 = 0.47973$

$a_0 = \log \lambda$

$0.27511 = \log \lambda$

$\lambda = 1.8841$

$a_1 = \log \beta$

$0.47973 = \log \beta$

$\beta = 3.0181$

$\lambda = 1.8841$

$\beta = 3.0181$

d) Correlation Co-efficient

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

$$R = \frac{(11 \times 199.8268839) - (55)(39.41133046)}{\sqrt{(11 \times 385 - 55^2) * [(11 \times 103.9620485 - (39.41133046)^2]}}$$

$$R = 0.999844831$$

$$R \text{ square} = (0.999844831)^2$$

$$= 0.999689684$$

For manual method

For manual Method

$R = 0.999844831$

$R^2 = 0.999689684$

For mat lab

$R = 0.9998$

$R^2 = 0.9997$

For excel

$R = 0.999844832357633$

$R^2 = 0.999689687922573$

d) 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