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Course :- ENG 382
Date :- 02/04/2019

Given $d = \alpha\beta^t$

Comparing equation 1 to $y =$

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

~~Skip~~ $\cancel{\alpha_0 = \log \alpha}$

$\cancel{\alpha_1 = \log \beta}$

Solution

1)

	$Y = \log d$	$t = x$	XY	$d(m)$	x^2	Y^2
1	0.301029996	0	0	2	0	0.090619
2	0.698970004	1	0.698970004	5	1	0.488559
3	1.278753601	2	2.557507202	19	4	1.635211
4	1.698970004	3	5.096910013	50	9	2.886499
5	2.178976947	4	8.715907789	151	16	4.747941
6	2.672097858	5	13.36048929	470	25	7.140107
7	3.156851901	6	18.94111141	1435	36	9.965714
8	3.654369091	7	25.58058364	4512	49	13.35441
9	4.111800007	8	32.89440006	12936	64	16.9069
10	4.614105911	9	41.5269532	41125	81	21.28997
11	5.045405135	10	50.45405135	111021	100	25.45611
	$\Sigma Y = 29.41133046$	$\Sigma x = 55$	$\Sigma xY = 199.8368839$		$\Sigma x^2 = 385$	$\Sigma Y^2 = 103.96205$

~~ΣXF 36N/t/α,β,X~~

$$d = \alpha\beta^t$$

$$\log d = \log(\alpha\beta^t) = \log \alpha + \log \beta^t$$

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

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

$$\Rightarrow \sum \log d = n \log \alpha + \sum t \log \beta$$

$$t \log d = t \log \alpha + t^2 \log \beta$$

$$\Rightarrow \sum t \log d = \log \alpha \sum t + \log \beta \sum t^2$$

$$\begin{bmatrix} n & \sum t \\ \sum t & \sum t^2 \end{bmatrix} \begin{bmatrix} \log \alpha \\ \log \beta \end{bmatrix} = \begin{bmatrix} \sum \log d \\ \sum t \log d \end{bmatrix}$$

$$\underset{A}{\begin{bmatrix} 11 & 55 \\ 55 & 385 \end{bmatrix}} \underset{X}{\begin{bmatrix} \log \alpha \\ \log \beta \end{bmatrix}} = \underset{B}{\begin{bmatrix} 29.41133 \\ 199.8269 \end{bmatrix}}$$

$$X = A^{-1} B$$

$$= \begin{bmatrix} 0.318182 & -0.04545 \\ -0.04545 & 0.009091 \end{bmatrix} \begin{bmatrix} 29.41133 \\ 199.8269 \end{bmatrix}$$

$$\begin{bmatrix} \log \alpha \\ \log \beta \end{bmatrix} = \begin{bmatrix} 0.27511 \\ 0.479729 \end{bmatrix}$$

$$\log \alpha = 0.27511 \qquad \log \beta = 0.479729$$

$$\alpha = 10^{0.27511} \qquad \beta = 10^{0.479729}$$

$$\alpha = 1.8841 \qquad \beta = 3.0181$$

t (hr)	d(m)	log d	log dsom	log dsommerror	log dmerror
0	2	0.30103	0.27511	-2.398646894	-2.3727273
1	5	0.69897	0.754884	-1.918917515	-1.9747873
2	19	1.278754	1.234569	-1.439188136	-1.3950037
3	50	1.69897	1.714299	-0.959458758	-0.9747873
4	151	2.178477	2.194028	-0.479729379	-0.4947804
5	470	2.672098	2.673757	0	-0.0016595
6	1435	3.156852	3.153487	0.479729379	0.483094459
7	4512	3.654369	3.633216	0.959458758	0.98061178
8	12936	4.111845	4.112945	1.439188136	1.438044269
9	41125	4.614106	4.592675	1.918917515	1.9403486
10	111021	5.045405	5.072404	2.398646894	2.37164782

$$\log d_{som} = \log \alpha + t \log B$$

~~y_{mean} = 0.27511 + 0.754884 + 1.234569 ...~~

$y = \log d$

$$y_{mean} = 0.30103 + 0.69897 + 1.278754 + 1.6987 + 2.178477 + 2.672098 + 3.156852 + 3.654369 + 4.111845 + 4.614106 ~~+ 4.592675~~ + 5.045404 = 28.410551$$

$$\log d_{somm}\,error = \log d_{som} - y_{mean}$$

$$\log d_{m}\,error = \log d - y_{mean}$$

$$R = \sqrt{\frac{(\Sigma \log d_{somm}error)^2}{(\Sigma \log d_{m}error)^2}} = \sqrt{\frac{5.031444172^2}{5.03222501^2}} = 0.9998$$

$$R^2 = 0.9996$$

d) From the observation of 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.