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16/ENG05/004
Mechatronics Engineering
ENG 382 Assignment

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

Comparing equation (1) to $y = mx + c$

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

where $a_0 = \log \alpha$

$a_1 = \log \beta$

	$Y = \log d$	$t = x$	d_m	xy	x^2	Y^2
1	0.301029996	0	0	0	0	0.09061905
2	0.698970004	1	1	0.698970004	1	0.488559067
3	1.278753601	2	2	2.557507202	4	1.635210772
4	1.698970004	3	3	5.096910013	9	2.886499076
5	2.178976947	4	4	8.715907789	16	4.7478940537
	2.672097858	5	5	13.36048929	25	7.140106962
	3.156851909	6	6	18.9411141	36	9.965713925
	3.654369091	7	7	25.58058304	49	13.35441345
	4.111800007	8	8	32.89440006	64	16.9068993
	4.64165911	9	9	41.5269532	81	21.28997336
	5.045405135	10	10	50.45405135	100	25.45611297

$\Sigma y = 29.41133046$

$\Sigma x = 55$

$\Sigma xy = 199.8268839$

$\Sigma x^2 = 385$

$\Sigma y^2 = 103.9620485$

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

$29.41133046 = a_0(11) + a_1(5.5)$

$\Sigma xy = a_0 \Sigma x + a_1 \Sigma x^0$

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

Solving eqn (i) & (ii)

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$$29.41133046 = 11a_0 + 55a_1$$

$$199.8268839 = 55a_0 + 385a_1$$

Using cramer's rules

$$a_0 = \frac{\begin{vmatrix} 29.41133046 & 55 \\ 199.8268839 & 385 \end{vmatrix}}{\begin{vmatrix} 11 & 55 \\ 55 & 885 \end{vmatrix}}$$

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

$$a_0 = 0.27511$$

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

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

$$a_1 = 0.42973$$

Recall that;

$$a_0 = \log \alpha$$

$$0.25511 = \log \alpha$$

$$\alpha = 1.8841$$

$$a_1 = \log \beta$$

$$0.42973 = \log \beta$$

$$\beta = 3.0181$$

Therefore;

$$\alpha = 1.8841$$

$$\beta = 3.0181$$

d) Correlation Coefficient.

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

$$R = \frac{(11 \times 199.8268839) - (55)(29.4113 3046)}{\sqrt{(11 \times 385) - 55^2)(11 \times 103.9620485 - 29.41113046)^2)}}$$

$$R = 0.999844 8312.$$

$$R_{square} = (0.9998448312)^2$$
answer
$$= 0.99968 96864$$

Matlab answer $R = 0.9998$

$R^2 = 0.9997$

Excel answer

$R = 0.999844323 5763$

$R^2 = 0.99968968879 2252$

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