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16/ENG05/017
Mechatronics Engr.
Engineering Mathematics

Assignment 6

t(hr)	d(m)
0	2
1	5
2	19
3	80
4	151
5	470
6	1435
7	4512
8	12936
9	41125
10	111021

$d = \alpha \beta^t$

$\text{Log}\, d = \text{Log}\, \alpha + \text{Log}\, \beta^t$ (taking the log of both sides)

$\text{Log}\, d = \text{Log}\, \alpha + t\, \text{Log}\, \beta$

$y = a_0 + a_1 x$

$a_1 = \text{Log}\, \beta$

$a_0 = \text{Log}\, \alpha$

$y = \text{Log}\, d$

$\Sigma y = N a_0 + a_1 \Sigma x$ ——①

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

where $n = 11$

From the table

$\Sigma x = 55$

$\Sigma y = 29.4113$

$\Sigma xy = 199.8269$

$\Sigma x^2 = 385$

$\Sigma y^2 = 103.962$

t(x)	d	Log d(y)	xy	x^2	y^2
0	2	0.30103	0	0	6.096619
1	5	0.09899	0.69899	1	0.488559
2	19	1.278754	2.55754	4	1.635211
3	50	1.69897	5.09691	9	2.886499
4	151	2.178933	8.715908	16	4.747941
5	470	2.672048	13.36049	25	7.140107
6	1435	3.156852	18.94111	36	9.965714
7	4512	3.654369	25.58058	49	13.13441
8	12936	4.1118	52.8944	64	16.9096
9	41125	4.614128	41.52692	81	21.28997
10	111021	5.043404	50.45405	100	25465111
55	171726	29.41135	199.8269	385	103.962

$29.4113 = 11a_0 + 55a_1$ ——— (1)

$199.8269 = 55a_0 + 385a_1$ ——— (2)

$29.41133 - 55a_1 = 11a_0$

$a_0 = \frac{29.4113 - 55a_1}{11}$ ——— (3)

Sub eqn 3 into 2 we have

$199.8269 = 85\left(\frac{29.41133 - 55a_1}{11}\right) + 385a_1$

$199.82692 = 5(29.41133 - 55a_1) + 385a_1$

$199.82692 = 142.05662 - 275a_1 + 385a_1$

$199.8269 - 147.05662 = 385a_1 - 257a_1$

$52.77025 = 110a_1$

$a_1 = \frac{52.77025}{110}$

$a_1 = 0.4797$

Sub a_1 into eqn 3

$a_0 = \frac{29.41133 - 55(0.4999)}{11}$

$a_0 = 0.2752$

$a_0 = \log \alpha$

$\alpha = \text{Log}^{-1} a_0$

$= \text{Log}^{-1} 0.2752$

$\alpha = 1.8845$

$a_1 = \text{Log } B$

$B = \text{Log}^{-1} a_1$

$= \text{Log}^{-1} 0.4797$

$B = 3.0179$

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

$R = \frac{(11 \times 199.8209) - (55 \times 29.41133)}{\sqrt{(11 \times 385) - 55^2 \; [(11 \times 103.962) - 29.41133^2}}$

$R = 0.9998460887$

$R^2 = (0.9998460887)^2$

$R^2 = 0.9998$

Since

d) From Observation, it can be seen that $R^2 < R$ Cie the value of the source of the Correlation Coefficient is lesser than the actual value of the Correlation Coefficient.