

Name:
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Gt:

Inve Inve - Essien

16/BNW/101

Chemical Engineering

BNW 382

Assignment 6.

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

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

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

t (hr)	d	log d	t ²	t log d
0	2	0.3010	0	0
1	5	0.6990	1	0.6990
2	14	1.2788	4	2.5576
3	50	1.6990	9	5.097
4	151	2.1790	16	8.716
5	470	2.6721	25	13.3605
6	1435	3.1569	36	18.9411
7	4512	3.6544	49	25.58058
8	12936	4.1118	64	32.8944
9	41125	4.6141	81	41.52695
10	111021	5.0454	100	50.45405
55			385	199.8269

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

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

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

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

A X B

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

$$= \begin{bmatrix} 0.318182 & -0.04545 \\ -0.04545 & 0.007091 \end{bmatrix} \begin{bmatrix} 29.41133 \\ 199.8269 \end{bmatrix}$$

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

$$\log \alpha = 0.27511$$

$$\alpha = \text{anti} \log (0.27511)$$

$$\alpha = 1.8841$$

$$\log \beta = 0.479729$$

$$\beta = \text{anti} \log (0.479729)$$

$$\beta = 3.0181$$

t(hr)	d(m)	log d	log d sim	log d sim error	log d m error
0	2	0.30103	0.27511	-2.398646894	-2.3727273
1	5	0.69897	0.75484	-1.918917515	-1.9747873
2	14	1.278754	1.234569	-1.439188136	-1.3950037
3	50	1.6987	1.714299	-0.959458758	-0.9747873
4	151	2.178977	2.194028	-0.479729379	-0.4947804
5	470	2.672098	2.673757	0	-0.0016595
6	1435	3.156852	3.153487	0.479729379	0.48309459
7	4512	3.633216	3.633216	0.959458758	0.98061178
8	12936	4.112945	4.112945	1.439188136	1.43804269
9	41125	4.524675	4.592675	1.918917515	1.9403486
10	111021	5.072404	5.072404	2.398646894	2.37164782
				5.031444172	5.03222501

$$\log d_{sim} = \log d + t \log \beta$$

$$\begin{aligned} \bar{d}_{mean} = & 0.27511 + 0.75484 + 1.234569 + 1.714299 + 2.194028 \\ & + 2.673757 + 3.153487 + 3.633216 + 4.112945 + \\ & 4.592675 + 5.072404 \end{aligned}$$

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$$\bar{d}_{mean} = 2.673757$$

$$\log d_{sim error} = \log d_{sim} - \bar{d}_{mean}$$

$$\log d_{m error} = \log d - \bar{d}_{mean}$$

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

$$R^2 = 0.9996$$

(4) There is a high correlation between t and d because of the R value