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16/ENG06/006

ENG 382 ASSIGNMENT 6

MECHANICAL ENGINEERING

1.

Ajayeoba Oyinkan Eloho
16/ENG06/006
Mechanical Engineering

ENG 382 Assignment 6

Solution

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

$x = t$ (hr)	d	$y = \log d$	x^2	xy	y^2
0	2	0.30103	0	0	0.09062
1	5	0.69897	1	0.69897	0.48886
2	19	1.27875	4	2.5575	1.6352
3	50	1.69897	9	5.09691	2.8896
4	151	2.17898	16	8.71592	4.7480
5	470	2.672098	25	13.36049	7.14011
6	1435	3.15685	36	18.9411	9.9657
7	4512	3.65437	49	25.58059	13.3544
8	12936	4.111800	64	32.8944	16.9069
9	41125	4.614106	81	41.5270	21.2900
10	111021	5.045341	100	50.4540	25.4562
55	171726	29.4113	385	199.8269	103.962

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

$a_0 = \log \alpha$

$a_1 = \log \beta$

$y = a_0 + a_1 x$

$n = 11$

$\Sigma x = 55$

$\Sigma y = 29.4113$

$\Sigma xy = 199.8269$

$\Sigma x^2 = 385$

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

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

$29.4113 = 11 a_0 + 55 a_1$

$199.8265 = 55 a_0 + 385 a_1$

using Cramers method

$$a_0 = \frac{\begin{vmatrix} 29.4113 & 55 \\ 199.8269 & 385 \end{vmatrix}}{\begin{vmatrix} 11 & 55 \\ 55 & 385 \end{vmatrix}}$$

1.

$$a_0 = \frac{29.4113(385) - 55(199.8269)}{11(385) - 55(55)}$$

$$a_0 = 0.2751$$

$$a_1 = \frac{\begin{vmatrix} 11 & 29.4113 \\ 55 & 199.8269 \end{vmatrix}}{\begin{vmatrix} 11 & 55 \\ 55 & 385 \end{vmatrix}}$$

$$a_1 = \frac{11(199.8269) - 55(29.4113)}{11(385) - 55(55)}$$

$$a_1 = 0.4797$$

$$a_0 = -\log \alpha$$

$$a_1 = \log \beta$$

$$0.2751 = \log \alpha \qquad 0.4797 = \log \beta$$

$$\alpha = 10^{0.2751} \qquad \beta = 10^{0.4797}$$

$$\alpha = 1.8867 \qquad \beta = 3.0179$$

$$\alpha \simeq 1.87 \qquad \beta \simeq 3.02$$

$$Y = a_0 + a_1 X$$

$$Y = 0.27 + 0.48X$$

Correlation Coefficient

$$R = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{(N\Sigma X^2 - (\Sigma X)^2)(N\Sigma Y^2 - (\Sigma Y)^2)}}$$

$$R = \frac{11(199.8269) - (55)(29.4113)}{\sqrt{(11 \times 385 - (55)^2)(11 \times 108.962 - (29.4113)^2}}$$

$$R = 0.9998438$$

$$R^2 = 0.9998438^2$$

$$R^2 = 0.9996872$$

MICROSOFT EXCEL

X1	d	Y	X^2	XY	Y^2	Correlation Coefficient R	R^2	X0
0	2	0.30103	0	0	0.090619	0.999844832	0.99969	1
1	5	0.69897	1	0.69897	0.488559			1
2	19	1.278754	4	2.557507	1.635211			1
3	50	1.69897	9	5.09691	2.886499			1
4	151	2.178977	16	8.715908	4.747941			1

5	470	2.672098	25	13.36049	7.140107	1
6	1435	3.156852	36	18.94111	9.965714	1
7	4512	3.654369	49	25.58058	13.35441	1
8	12936	4.1118	64	32.8944	16.9069	1
9	41125	4.614106	81	41.52695	21.28997	1
10	111021	5.045405	100	50.45405	25.45611	1
55		29.41133	385	199.8269	103.962	

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999845
R Square	0.99969
Adjusted R Square	0.999655
Standard Error	0.029549
Observations	11

ANOVA

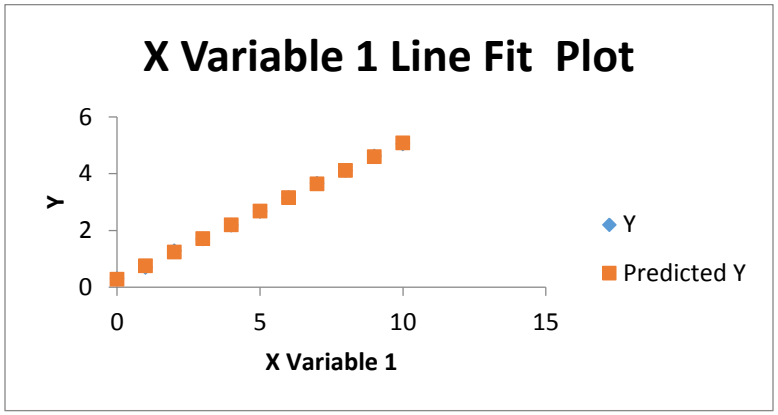
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	25.31543	25.31543	28994.14	4.23E-17
Residual	9	0.007858	0.000873		
Total	10	25.32329			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.27511	0.016668	16.50562	4.9E-08	0.237406	0.312815	0.237406	0.312815
X Variable 1	0.479729	0.002817	170.2767	4.23E-17	0.473356	0.486103	0.473356	0.486103

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*
1	0.27511	0.02592
2	0.75484	-0.05587
3	1.234569	0.044184

4	1.714299	-0.01533
5	2.194028	-0.01505
6	2.673757	-0.00166
7	3.153487	0.003365
8	3.633216	0.021153
9	4.112945	-0.00115
10	4.592675	0.021431
11	5.072404	-0.027



MATLAB

```
commandwindow
clc
clear

oyin=xlsread('OyinRegress')
X0=oyin(:,9)
X1=oyin(:,1)
y=oyin(:,3)
x=[X0 X1]
dat=regress(y,x)
a0=dat(1)
a1=dat(2)
ysim=a0+(a1*X1)
r=corr(y,ysim)
r_sq=r^2
```

oyin =

1.0e+05 *

0	0.0000	0.0000	0	0	0.0000	NaN	NaN	0.0000
0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	NaN	NaN	0.0000
0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	NaN	NaN	0.0000
0.0000	0.0005	0.0000	0.0001	0.0001	0.0000	NaN	NaN	0.0000
0.0000	0.0015	0.0000	0.0002	0.0001	0.0000	NaN	NaN	0.0000
0.0001	0.0047	0.0000	0.0003	0.0001	0.0001	NaN	NaN	0.0000
0.0001	0.0143	0.0000	0.0004	0.0002	0.0001	NaN	NaN	0.0000
0.0001	0.0451	0.0000	0.0005	0.0003	0.0001	NaN	NaN	0.0000
0.0001	0.1294	0.0000	0.0006	0.0003	0.0002	NaN	NaN	0.0000
0.0001	0.4113	0.0000	0.0008	0.0004	0.0002	NaN	NaN	0.0000
0.0001	1.1102	0.0001	0.0010	0.0005	0.0003	NaN	NaN	0.0000

X0 =

1
1
1
1
1
1
1
1
1
1
1

X1 =

0

1

2

3

4

5

6

7

8

9

10

y =

0.3010

0.6990

1.2788

1.6990

2.1790

2.6721

3.1569

3.6544

4.1118

4.6141

5.0454

```
x =

     1     0
     1     1
     1     2
     1     3
     1     4
     1     5
     1     6
     1     7
     1     8
     1     9
     1    10


dat =

    0.2751
    0.4797


a0 =

    0.2751


a1 =

    0.4797
```

```
ysim =

    0.2751
    0.7548
    1.2346
    1.7143
    2.1940
    2.6738
    3.1535
    3.6332
    4.1129
    4.5927
    5.0724


r =

    0.9998


r_sq =

    0.9997

>>
```

D. From the results obtained from the Matlab method of solving regression, it was observed that the values of a1, a0, correlation coefficient r, and square of correlation coefficient r^2 have the same values with the Excel method and approximately the same values as using the manual method.