Regression

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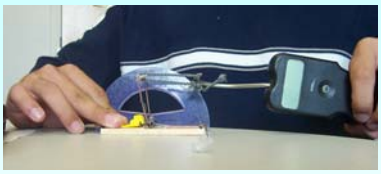
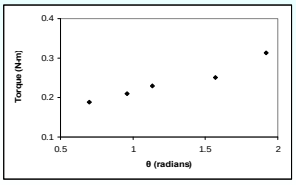
Applications

Mousetrap Car

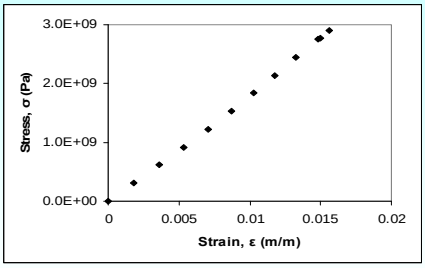
Torsional Stiffness of a Mousetrap Spring





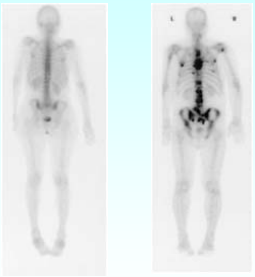
$$T = k_0 + k_1 \theta$$

Stress vs Strain in a Composite Material

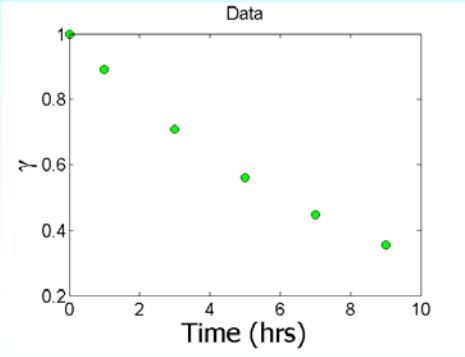


$$\sigma = E\varepsilon$$

A Bone Scan

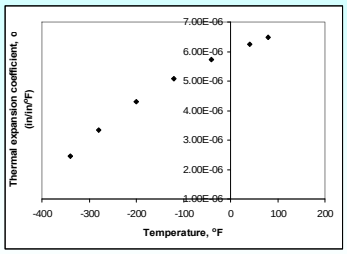


Radiation intensity from Technitium-99m



Trunnion-Hub Assembly

Thermal Expansion Coefficient Changes with Temperature?



$$\alpha = a_0 + a_1 T + a_2 T^2$$

Pre-Requisite Knowledge

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Close to half of the scores in a test given to a class are above the

A. average score
B. median score
C. standard deviation
D. mean score

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Given $y_1, y_2, \ldots\ldots\ldots y_n$, the standard deviation is defined as

1. $\sum_{i=1}^{n}[y_i - \bar{y}]^2 / n$
2. $\sqrt{\sum_{i=1}^{n}[y_i - \bar{y}]^2 / n}$
3. $\sum_{i=1}^{n}[y_i - \bar{y}]^2 /(n-1)$
4. $\sqrt{\sum_{i=1}^{n}[y_i - \bar{y}]^2 /(n-1)}$

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Linear Regression

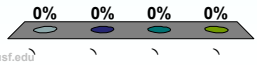
Given (x_1,y_1), (x_2,y_2),…… (x_n,y_n), best fitting data to $y=f(x)$ by least squares requires minimization of

A.) $\sum_{i=1}^{n}[y_i - f(x_i)]$

B.) $\sum_{i=1}^{n}|y_i - f(x_i)|$

C.) $\sum_{i=1}^{n}[y_i - f(x_i)]^2$

D.) $\sum_{i=1}^{n}[y_i - \bar{y}]^2, \bar{y} = \frac{\sum_{i=1}^{n} y_i}{n}$



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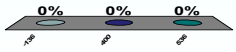
The following data

x	1	20	30	40
y	1	400	800	1300

is regressed with least squares regression to a straight line to give y=-116+32.6*x*. The **observed** value of y at *x*=20 is

1. -136
2. 400
3. 536



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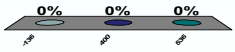
The following data

x	1	20	30	40
y	1	400	800	1300

is regressed with least squares regression to a straight line to give y=-116+32.6*x*. The **predicted** value of y at *x*=20 is

1. -136
2. 400
3. 536



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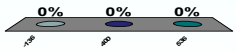
The following data

x	1	20	30	40
y	1	400	800	1300

is regressed with least squares regression to a straight line to give y=-116+32.6x. The **residual** of y at x=20 is

1. -136
2. 400
3. 536



Nonlinear Regression

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When transforming the data to find the constants of the regression model $y=ae^{bx}$ to best fit (x_1,y_1), (x_2,y_2),..... (x_n,y_n), the sum of the square of the residuals that is minimized is

1. $\sum_{i=1}^{n}\left(y_i - ae^{bx_i}\right)^2$
2. $\sum_{i=1}^{n}\left(\ln(y_i) - \ln a - bx_i\right)^2$
3. $\sum_{i=1}^{n}\left(y_i - \ln a - bx_i\right)^2$
4. $\sum_{i=1}^{n}\left(\ln(y_i) - \ln a - b\ln(x_i)\right)^2$

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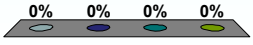
When transforming the data for stress-strain curve $\sigma = k_1\varepsilon e^{-k_2\varepsilon}$ for concrete in compression, where σ is the stress and ε is the strain, the model is rewritten as

A.) $\ln\sigma = \ln k_1 + \ln\varepsilon - k_2\varepsilon$

B.) $\ln\frac{\sigma}{\varepsilon} = \ln k_1 - k_2\varepsilon$

C.) $\ln\frac{\sigma}{\varepsilon} = \ln k_1 + k_2\varepsilon$

D.) $\ln\sigma = \ln(k_1\varepsilon) - k_2\varepsilon$



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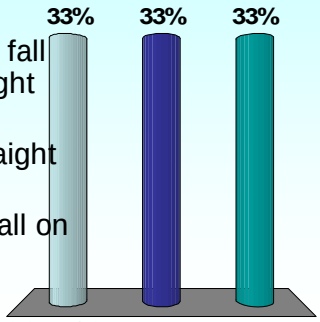
Adequacy of Linear Regression Models

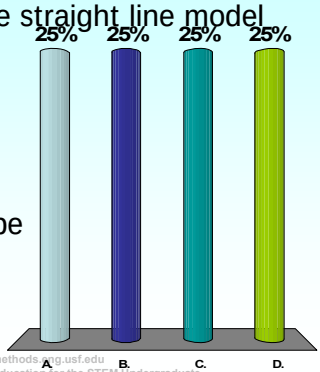
The case where the coefficient of determination for regression of n data pairs to a straight line is **one** if

A. none of data points fall exactly on the straight line
B. the slope of the straight line is zero
C. all the data points fall on the straight line



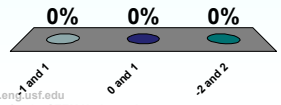
The case where the coefficient of determination for regression of n data pairs to a general straight line is **zero** if the straight line model

A. has zero intercept
B. has zero slope
C. has negative slope
D. has equal value for intercept and the slope



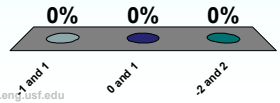
The coefficient of determination varies between

A. -1 and 1
B. 0 and 1
C. -2 and 2



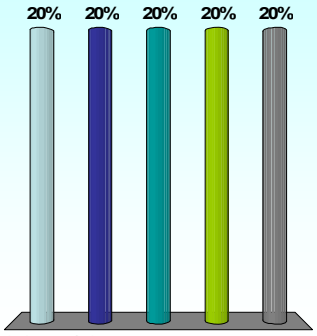
The correlation coefficient varies between

A. -1 and 1
B. 0 and 1
C. -2 and 2



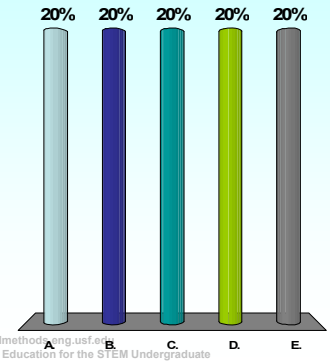
If the coefficient of determination is 0.25, and the straight line regression model is y=2-0.81x, the correlation coefficient is

A. -0.25
B. -0.50
C. 0.00
D. 0.25
E. 0.50



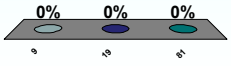
If the coefficient of determination is 0.25, and the straight line regression model is y=2-0.81x, the strength of the correlation is

A. Very strong
B. Strong
C. Moderate
D. Weak
E. Very Weak



If the coefficient of determination for a regression line is 0.81, then the percentage amount of the original uncertainty in the data explained by the regression model is

A. 9
B. 19
C. 81



The percentage of scaled residuals expected to be in the domain [-2,2] for an adequate regression model is

A. 85

B. 90

C. 95

D. 100