

Wednesday May 7

- no attendance
- I will answer any Questions
- I am not preparing anything

Attendance
May 5
1 - E

Printout

Friday, May 2, 2025

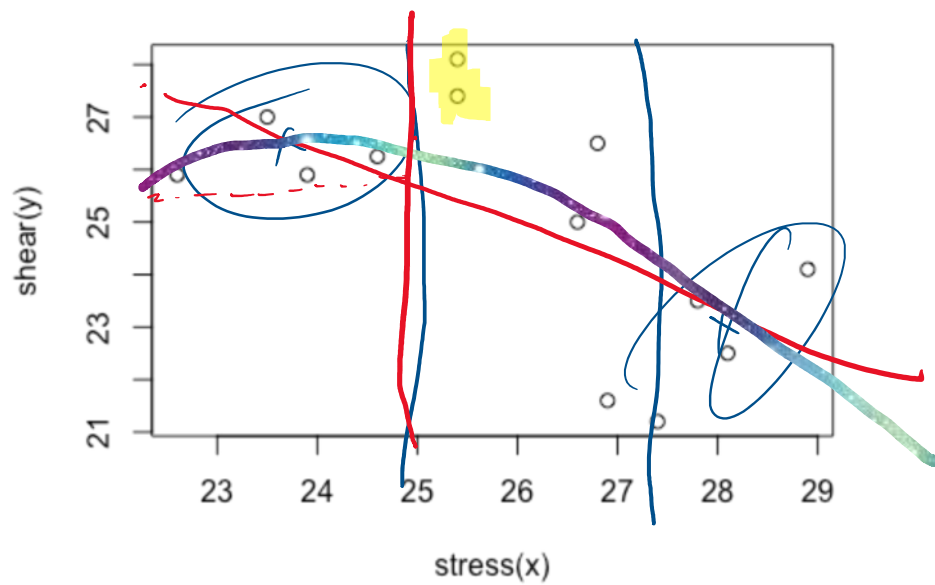
11:05 AM

Regression Review

Question 1 - Slope

Consider the scatterplot shown below. Which statement most accurately describes the slope shown?

1. The slope is positive
2. The slope is negative
3. The slope is approximately zero
4. Cannot determine from information provided



$$y = \beta_0 + \beta_1 x + \varepsilon$$

Question 2 - Y-intercept

What is the value of y-intercept (β_0)?

1. 44.022
2. -0.732
3. 7.063
4. 0.271
5. The correct answer is not provided

```
slr <- lm(y~x,data=df)
summary(slr)
```

```
##
## Call:
## lm(formula = y ~ x, data = df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.7658 -0.9534  0.1796  1.2322  2.6703
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   44.022      7.063    6.233 6.41e-05 ***
## x             -0.732      0.271   -2.701  0.0206 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.813 on 11 degrees of freedom
## Multiple R-squared:  0.3987, Adjusted R-squared:  0.344
## F-statistic: 7.293 on 1 and 11 DF, p-value: 0.02064
```

Question 3 - Slope

What is the value of the slope (β_1)?

1. 44.022
2. -0.732
3. 7.063
4. 0.271
5. The correct answer is not provided

```
slr <- lm(y~x,data=df)
summary(slr)

##
## Call:
## lm(formula = y ~ x, data = df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.7658 -0.9534  0.1796  1.2322  2.6703
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   44.022      7.063    6.233 6.41e-05 ***
## x             -0.732      0.271   -2.701  0.0206 *
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## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
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## Multiple R-squared:  0.3987, Adjusted R-squared:  0.344
## F-statistic: 7.293 on 1 and 11 DF, p-value: 0.02064
```

Question 4 - Fitted Value or predicted value

What is the predicted value of shear (y) when stress(x)=25?

1. -61.517
2. 13.838
3. 25.722
4. The correct answer is not provided

```
slr <- lm(y~x,data=df)
summary(slr)
```

```
##
## Call:
## lm(formula = y ~ x, data = df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.7658 -0.9534  0.1796  1.2322  2.6703
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   44.022      7.063   6.233 6.41e-05 ***
## x             -0.732      0.271  -2.701  0.0206 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.813 on 11 degrees of freedom
## Multiple R-squared:  0.3987, Adjusted R-squared:  0.344
## F-statistic: 7.293 on 1 and 11 DF, p-value: 0.02064
```

$$\begin{aligned}\hat{y} &= \hat{\beta}_0 + \hat{\beta}_1 x \\ &= 44.022 + (-0.732)(25) \\ &= 25.722\end{aligned}$$

$$e_i = y_i - \hat{y}_i \quad (\text{actual} - \text{predicted})$$

$$= y_i - (\hat{\beta}_0 + \hat{\beta}_1 x)$$

Question 5 - Residual

What is the value of the residual when stress(x)=25.6 and strain(y)=24.9?

1. -0.1952
2. 0.1952
3. 0.3828

4. The correct answer is not provided

```
slr <- lm(y~x, data=df)
summary(slr)
```

```
##
## Call:
## lm(formula = y ~ x, data = df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.7658 -0.9534  0.1796  1.2322  2.6703
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   44.022      7.063   6.233 6.41e-05 ***
## x             -0.732      0.271  -2.701  0.0206 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.813 on 11 degrees of freedom
## Multiple R-squared:  0.3987, Adjusted R-squared:  0.344
## F-statistic: 7.293 on 1 and 11 DF, p-value: 0.02064
```

$$= 24.9 - (44.022 + (-0.732)25.6)$$

$$= -0.3828$$

Question 6 - Hypothesis Test on y-intercept

What is the correct decision for the hypothesis test that $H_0: \beta_0 = 0$ versus $H_1: \beta_0 \neq 0$, using $\alpha = 0.01$?

1. Fail to reject H_0
2. Reject H_0
3. Cannot determine from the information provided.

```
slr <- lm(y~x,data=df)
summary(slr)
```

```
##
## Call:
## lm(formula = y ~ x, data = df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.7658 -0.9534  0.1796  1.2322  2.6703
##
## Coefficients:
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## (Intercept)   44.022      7.063    6.233 6.41e-05 ***
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```

I need α & p-value?

$\alpha = .01$

p-value = 6.41×10^{-5}

Is p-value $< \alpha$?
yes $\rightarrow$ Reject H_0

Question 7 - Hypothesis Test on Slope Term

What is the correct decision for the hypothesis test that $H_0: \beta_1 = 0$ versus $H_1: \beta_1 \neq 0$, using $\alpha = 0.01$?

1. Fail to reject H_0
2. Reject H_0
3. Cannot determine from the information provided.

```
slr <- lm(y~x,data=df)
summary(slr)
```

```
##
## Call:
## lm(formula = y ~ x, data = df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.7658 -0.9534  0.1796  1.2322  2.6703
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##
## Residual standard error: 1.813 on 11 degrees of freedom
## Multiple R-squared:  0.3987, Adjusted R-squared:  0.344
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```

IS $0.0206 < 0.01$? No,
fail to reject H_0

p-value

Question 8 - Lack of Fit Test

What is the correct decision for the hypothesis test H_0 : there is no lack of fit versus H_1 : there is lack of fit, using $\alpha = 0.01$?

1. Fail to reject H_0
 2. Reject H_0
 3. Cannot determine from the information provided
- ```
library(EnvStats)
```

```
##
Attaching package: 'EnvStats'

The following objects are masked from 'package:stats':
##
predict, predict.lm

anovaPE(slr)

Df Sum Sq Mean Sq F value Pr(>F)
x 1 23.965 23.9649 97.816 0.06415 .
Lack of Fit 10 35.902 3.5902 14.654 0.20078
Pure Error 1 0.245 0.2450

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

$$\alpha = .01$$

$$P\text{-value} = .20078$$

Is  $P\text{-value} < \alpha$ ?

No, fail to reject  $H_0$

P-value