Quiz 1

Quiz, 10 questions

10/10 points (100%)

Congratulations! You passed!

Next Item

1 / 1 points

1. Consider the data set given below

```
x <- c(0.18, -1.54, 0.42, 0.95)
```

And weights given by

```
w <- c(2, 1, 3, 1)
```

Give the value of μ that minimizes the least squares equation

$\sum_{i=1}^n w_i (x_i - \mu)^2$

- ( ) 0.300
- (x) 0.1471

Correct

```
sum(x * w)/sum(w)
```

```
## [1] 0.1471
```

- ( ) 0.0025
- ( ) 1.077

---

1 / 1 points

2. Consider the following data set

```
x <- c(0.8, 0.47, 0.51, 0.73, 0.36, 0.58, 0.57, 0.85, 0.44, 0.42)
y <- c(1.39, 0.72, 1.55, 0.48, 1.19, -1.59, 1.23, -0.65, 1.49, 0.05)
```

Fit the regression through the origin and get the slope treating y

as the outcome and x as the regressor. (Hint, do not center the data since we want regression through the origin, not through the means of the data.)

- ( ) -1.713
- ( ) 0.59915
- ( ) -0.04462
- (x) 0.8263

Correct

```
coef(lm(y ~ x - 1))
```

```
##      x
## 0.8263
```

```
sum(y * x)/sum(x^2)
```

```
## [1] 0.8263
```

---

1 / 1 points

3. Do $\verb|data(mtcars)|$ from the datasets package and fit the regression

model with mpg as the outcome and weight as the predictor. Give

the slope coefficient.

- ( ) 30.2851
- ( ) 0.5591
- ( ) -9.559
- (x) -5.344

Correct

```
data(mtcars)
summary(lm(mpg ~ wt, data = mtcars))
```

```
##
## Call:
## lm(formula = mpg ~ wt, data = mtcars)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -4.543 -2.365 -0.125  1.410  6.873
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   37.285      1.878   19.86  < 2e-16 ***
## wt            -5.344      0.559   -9.56  1.3e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.05 on 30 degrees of freedom
## Multiple R-squared:  0.753,  Adjusted R-squared:  0.745
## F-statistic: 91.4 on 1 and 30 DF,  p-value: 1.29e-10
```

```
attach(mtcars)
cor(mpg, wt) * sd(mpg)/sd(wt)
```

```
## [1] -5.344
```

```
detach(mtcars)
```

---

1 / 1 points

4. Consider data with an outcome (Y) and a predictor (X). The standard deviation of the predictor is one half that of the outcome. The correlation between the two variables is .5. What value would the slope coefficient for the regression model with Y as the outcome and X as the predictor?

- (x) 1

Correct

Note it is given that $sd(Y) / sd(X)=2$ and $\mathrm{Cor(Y, X)} = 0.5$.

Therefore, we know that the regression coefficient would be:

$$\mathrm{Cor}(Y, X) \frac{sd(Y)}{sd(X)} = 0.5 \times 2 = 1$$

- ( ) 4
- ( ) 0.25
- ( ) 3

---

1 / 1 points

5. Students were given two hard tests and scores were normalized to have empirical mean 0 and variance 1. The correlation between the scores on the two tests was 0.4. What would be the expected score on Quiz 2 for a student who had a normalized score of 1.5 on Quiz 1?

- ( ) 1.0
- ( ) 0.4
- ( ) 0.16
- (x) 0.6

Correct

This is the classic regression to the mean problem. We are expecting the

score to get multiplied by 0.4. So

```
1.5 * 0.4
```

```
## [1] 0.6
```

---

1 / 1 points

6. Consider the data given by the following

```
x <- c(8.58, 10.46, 9.01, 9.64, 8.86)
```

What is the value of the first measurement if x were normalized (to have mean 0 and variance 1)?

- ( ) 9.31
- (x) -0.9719

Correct

```
((x - mean(x))/sd(x))[1]
```

```
## [1] -0.9719
```

- ( ) 8.86
- ( ) 8.58

---

1 / 1 points

7. Consider the following data set (used above as well). What is the intercept for fitting the model with x as the predictor and y as the outcome?

```
x <- c(0.8, 0.47, 0.51, 0.73, 0.36, 0.58, 0.57, 0.85, 0.44, 0.42)
y <- c(1.39, 0.72, 1.55, 0.48, 1.19, -1.59, 1.23, -0.65, 1.49, 0.05)
```

- ( ) 1.252
- ( ) -1.713
- ( ) 2.105
- (x) 1.567

Correct

```
coef(lm(y ~ x))[1]
```

```
## (Intercept)
##       1.567
```

---

1 / 1 points

8. You know that both the predictor and response have mean 0. What

can be said about the intercept when you fit a linear regression?

- ( ) Nothing about the intercept can be said from the information given.
- ( ) It must be exactly one.
- (x) It must be identically 0.

Correct

The intercept estimate is $\bar Y - \beta_1 \bar X$ and so will be zero.

- ( ) It is undefined as you have to divide by zero.

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1 / 1 points

9. Consider the data given by

```
x <- c(0.8, 0.47, 0.51, 0.73, 0.36, 0.58, 0.57, 0.85, 0.44, 0.42)
```

What value minimizes the sum of the squared distances between these points and itself?

- (x) 0.573

Correct

This is the least squares estimate, which works out to be the mean in this case.

```
mean(x)
```

```
## [1] 0.573
```

- ( ) 0.36
- ( ) 0.8
- ( ) 0.44

---

1 / 1 points

10. Let the slope having fit Y as the outcome and X as the predictor be denoted as β_1. Let the slope from fitting X as the outcome and Y as the predictor be denoted as γ_1. Suppose that you divide β_1 by γ_1; in other words consider β_1 / γ_1. What is this ratio always equal to?

- ( ) 1
- ( ) $2SD(Y) / SD(X)$
- (x) $Var(Y) / Var(X)$

Correct

The $\beta_1 = Cor(Y, X) SD(Y) / SD(X)$ and $\gamma_1= Cor(Y, X) SD(X) / SD(Y)$.

Thus the ratio is then $Var(Y) / Var(X)$.

- ( ) $Cor(Y, X)$