

Feedback — Quiz 1

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You submitted this quiz on **Sat 12 Dec 2015 12:56 PM EST**. You got a score of **10.00** out of **10.00**.

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

Your Answer	Score	Explanation
<input type="radio"/> 0.300		
<input type="radio"/> 0.0025		
<input type="radio"/> 1.077		
<input checked="" type="radio"/> 0.1471	✓ 1.00	
Total	1.00 / 1.00	

Question Explanation

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

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

Question 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.)

Your Answer		Score	Explanation
<input checked="" type="radio"/> 0.8263	✓	1.00	
<input type="radio"/> 0.59915			
<input type="radio"/> -1.713			
<input type="radio"/> -0.04462			
Total		1.00 / 1.00	

Question Explanation

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

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

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

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

Question 3

Do `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.

Your Answer		Score	Explanation
<input type="radio"/> -9.559			
<input checked="" type="radio"/> -5.344	✓	1.00	
<input type="radio"/> 0.5591			

Total

1.00 / 1.00

Question Explanation

```
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)
```

Question 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?

Your Answer	Score	Explanation
<input type="radio"/> 4		
<input type="radio"/> 3		
<input type="radio"/> 0.25		
<input checked="" type="radio"/> 1	✓ 1.00	
Total	1.00 / 1.00	

Question Explanation

Note it is given that $sd(Y)/sd(X) = 2$ and $Cor(Y, X) = 0.5$. Therefore, we know that the regression coefficient would be:

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

Question 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?

Your Answer	Score	Explanation
<input type="radio"/> 0.16		
<input type="radio"/> 1.0		
<input checked="" type="radio"/> 0.6	✓ 1.00	
<input type="radio"/> 0.4		
Total	1.00 / 1.00	

Question Explanation

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
```

Question 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)?

Your Answer	Score	Explanation
<input type="radio"/> 9.31		
<input type="radio"/> 8.58		
<input checked="" type="radio"/> -0.9719	 1.00	
<input type="radio"/> 8.86		
Total	1.00 / 1.00	

Question Explanation

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

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

Question 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)
```

Your Answer	Score	Explanation
<input type="radio"/> -1.713		
<input checked="" type="radio"/> 1.567	✓ 1.00	
<input type="radio"/> 1.252		
<input type="radio"/> 2.105		
Total	1.00 / 1.00	

Question Explanation

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

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

Question 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?

Your Answer	Score	Explanation
<input type="radio"/> It is undefined as you have to divide by zero.		
<input type="radio"/> It must be exactly one.		

☒ It must be identically 0.

✓ 1.00

☐ Nothing about the intercept can be said from the information given.

Total 1.00 / 1.00

Question Explanation

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

Question 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?

Your Answer

Score

Explanation

☒ 0.573



1.00

☐ 0.8

☐ 0.36

☐ 0.44

Total 1.00 / 1.00

Question Explanation


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

```
mean(x)
```

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


Question 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?

Your Answer	Score	Explanation
<input checked="" type="radio"/> $Var(Y)/Var(X)$	 1.00	
<input type="radio"/> $2SD(Y)/SD(X)$		
<input type="radio"/> 1		
<input type="radio"/> $Cor(Y, X)$		
Total	1.00 / 1.00	

Question Explanation

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 $Var(Y)/Var(X)$

