# Feedback — Quiz 2

Help

Thank you. Your submission for this quiz was received.

You submitted this quiz on **Mon 15 Dec 2014 12:25 PM PST**. You got a score of **10.00** out of **10.00**.

## Question 1

Consider the following data with x as the predictor and y as as the outcome.

```
x <- c(0.61, 0.93, 0.83, 0.35, 0.54, 0.16, 0.91, 0.62, 0.62)
y <- c(0.67, 0.84, 0.6, 0.18, 0.85, 0.47, 1.1, 0.65, 0.36)
```

Give a P-value for the two sided hypothesis test of whether $\beta_1$ from a linear regression model is 0 or not.

| Your Answer | | Score | Explanation |
|---|---|---|---|
| 2.325 | | | |
| 0.025 | | | |
| 0.05296 | ✔ | 1.00 | |
| 0.391 | | | |
| Total | | 1.00 / 1.00 | |

**Question Explanation**

```
summary(lm(y ~ x))$coef
```

```
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.1885     0.2061  0.9143  0.39098
## x             0.7224     0.3107  2.3255  0.05296
```

# Question 2

Consider the previous problem, give the estimate of the residual standard deviation.

| Your Answer | | Score | Explanation |
|---|---|---|---|
| 0.4358 | | | |
| 0.3552 | | | |
| 0.223 | ✔ | 1.00 | |
| 0.05296 | | | |
| Total | | 1.00 / 1.00 | |

**Question Explanation**

```
summary(lm(y ~ x))$sigma
```

```
## [1] 0.223
```

# Question 3

In the `mtcars` data set, fit a linear regression model of weight (predictor) on mpg (outcome). Get a 95% confidence interval for the expected mpg at the average weight. What is the lower endpoint?

| Your Answer | | Score | Explanation |
|---|---|---|---|
| 18.991 | ✔ | 1.00 | |
| 21.190 | | | |
| -6.486 | | | |

| | |
|---|---|
| ○ -4.00 | |
| Total | 1.00 / 1.00 |

**Question Explanation**

```
data(mtcars)
fit <- lm(mpg ~ I(wt - mean(wt)), data = mtcars)
confint(fit)
```

```
##                   2.5 % 97.5 %
## (Intercept)      18.991 21.190
## I(wt - mean(wt)) -6.486 -4.203
```

# Question 4

Refer to the previous question. Read the help file for `mtcars`. What is the weight coefficient interpreted as?

| Your Answer | | Score | Explanation |
|---|---|---|---|
| ◉ The estimated expected change in mpg per 1,000 lb increase in weight. | ✔ | 1.00 | |
| ○ The estimated expected change in mpg per 1 lb increase in weight. | | | |
| ○ The estimated 1,000 lb change in weight per 1 mpg increase. | | | |
| ○ It can't be interpreted without further information | | | |
| Total | | 1.00 / 1.00 | |

**Question Explanation**

This is the standard interpretation of a regression coefficient. The expected change in the

response per unit change in the predictor.

# Question 5

Consider again the `mtcars` data set and a linear regression model with mpg as predicted by weight (1,000 lbs). A new car is coming weighing 3000 pounds. Construct a 95% prediction interval for its mpg. What is the upper endpoint?

| Your Answer | | Score | Explanation |
|---|---|---|---|
| 14.93 | | | |
| 21.25 | | | |
| 27.57 | ✔ | 1.00 | |
| -5.77 | | | |
| Total | | 1.00 / 1.00 | |

**Question Explanation**

```
fit <- lm(mpg ~ wt, data = mtcars)
predict(fit, newdata = data.frame(wt = 3), interval = "prediction")
```

```
##     fit   lwr   upr
## 1 21.25 14.93 27.57
```

# Question 6

Consider again the `mtcars` data set and a linear regression model with mpg as predicted by weight (in 1,000 lbs). A “short” ton is defined as 2,000 lbs. Construct a 95% confidence interval for the expected change in mpg per 1 short ton increase in weight. Give the lower endpoint.

| Your Answer | Score | Explanation |
|---|---|---|

| | | |
|---|---|---|
| 4.2026 | | |
| -9.000 | | |
| -6.486 | | |
| -12.973 | ✔ | 1.00 |
| Total | | 1.00 / 1.00 |

**Question Explanation**

```
fit <- lm(mpg ~ wt, data = mtcars)
confint(fit)[2, ] * 2
```

```
##   2.5 %  97.5 %
## -12.973  -8.405
```

```
## Or equivalently change the units
fit <- lm(mpg ~ I(wt * 0.5), data = mtcars)
confint(fit)[2, ]
```

```
##   2.5 %  97.5 %
## -12.973  -8.405
```

# Question 7

If my X from a linear regression is measured in centimeters and I convert it to meters what would happen to the slope coefficient?

| Your Answer | | Score | Explanation |
|---|---|---|---|
| It would get multiplied by 10 | | | |
| It would get multiplied by 100. | ✔ | 1.00 | |
| It would get divided by 10 | | | |
| It would get divided by 100 | | | |

| | |
|---|---|
| Total | 1.00 / 1.00 |

**Question Explanation**

It would get multiplied by 100.

# Question 8

I have an outcome, $Y$, and a predictor, $X$ and fit a linear regression model with $Y = \beta_0 + \beta_1 X + \epsilon$ to obtain $\hat{\beta}_0$ and $\hat{\beta}_1$. What would be the consequence to the subsequent slope and intercept if I were to refit the model with a new regressor, $X + c$ for some constant, $c$?

| Your Answer | | Score | Explanation |
|---|---|---|---|
| The new intercept would be $\hat{\beta}_0 + c\hat{\beta}_1$ | | | |
| The new intercept would be $\hat{\beta}_0 - c\hat{\beta}_1$ | ✔ | 1.00 | |
| The new slope would be $\hat{\beta}_1 + c$ | | | |
| The new slope would be $c\hat{\beta}_1$ | | | |
| Total | | 1.00 / 1.00 | |

**Question Explanation**

This is exactly covered in the notes. But note that if $Y = \beta_0 + \beta_1 X + \epsilon$ then $Y = \beta_0 - c\beta_1 + \beta_1 (X + c) + \epsilon$ so that the answer is that the intercept gets subtracted by $c\beta_1$

# Question 9

Refer back to the mtcars data set with mpg as an outcome and weight (wt) as the predictor. About what is the ratio of the the sum of the squared errors, $\sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2$ when comparing a model with just an intercept (denominator) to the model with the intercept and slope (numerator)?

| Your Answer | | Score | Explanation |
|---|---|---|---|
| ◉ 0.25 | ✔ | 1.00 | |
| ○ 0.75 | | | |
| ○ 0.50 | | | |
| ○ 4.00 | | | |
| Total | | 1.00 / 1.00 | |

**Question Explanation**

This is simply one minus the R^2 values

```
fit1 <- lm(mpg ~ wt, data = mtcars)
fit2 <- lm(mpg ~ 1, data = mtcars)
1 - summary(fit1)$r.squared
```

```
## [1] 0.2472
```

```
sse1 <- sum((predict(fit1) - mtcars$mpg)^2)
sse2 <- sum((predict(fit2) - mtcars$mpg)^2)
sse1/sse2
```

```
## [1] 0.2472
```

# Question 10

Do the residuals always have to sum to 0 in linear regression?

| Your Answer | | Score | Explanation |
|---|---|---|---|
| ○ The residuals never sum to zero. | | | |
| ○ If an intercept is included, the residuals most likely won't sum to zero. | | | |
| ◉ If an intercept is included, then they will sum to 0. | ✔ | 1.00 | |

The residuals must always sum to zero.

| | |
|---|---|
| Total | 1.00 / 1.00 |

**Question Explanation**

They do provided an intercept is included. If not they most likely won't.