

Feedback — Quiz 3

[Help](#)

Thank you. Your submission for this quiz was received.

You submitted this quiz on **Fri 26 Dec 2014 9:54 AM PST**. You got a score of **7.00** out of **7.00**.

Question 1

Consider the `mtcars` data set. Fit a model with mpg as the outcome that includes number of cylinders as a factor variable and weight as confounder. Give the adjusted estimate for the expected change in mpg comparing 8 cylinders to 4.

Your Answer	Score	Explanation
<input type="radio"/> -3.206		
<input checked="" type="radio"/> -6.071	✓ 1.00	
<input type="radio"/> -4.256		
<input type="radio"/> 33.991		
Total	1.00 / 1.00	

Question Explanation

```
fit <- lm(mpg ~ factor(cyl) + wt, data = mtcars)
summary(fit)$coef
```

```
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   33.991      1.8878   18.006 6.257e-17
## factor(cyl)6  -4.256      1.3861   -3.070 4.718e-03
## factor(cyl)8  -6.071      1.6523   -3.674 9.992e-04
## wt            -3.206      0.7539   -4.252 2.130e-04
```

Question 2

Consider the `mtcars` data set. Fit a model with mpg as the outcome that includes number of cylinders as a factor variable and weight as a possible confounding variable. Compare the effect of 8 versus 4 cylinders on mpg for the adjusted and unadjusted by weight models. Here, adjusted means including the weight variable as a term in the regression model and unadjusted means the model without weight included. What can be said about the effect comparing 8 and 4 cylinders after looking at models with and without weight included?

Your Answer	Score	Explanation
<input type="radio"/> Holding weight constant, cylinder appears to have more of an impact on mpg than if weight is disregarded.		
<input checked="" type="radio"/> Holding weight constant, cylinder appears to have less of an impact on mpg than if weight is disregarded.	✓ 1.00	It is both true and sensible that including weight would attenuate the effect of number of cylinders on mpg.
<input type="radio"/> Within a given weight, 8 cylinder vehicles have an expected 12 mpg drop in fuel efficiency.		
<input type="radio"/> Including or excluding weight does not appear to change anything regarding the estimated impact of number of cylinders on mpg.		
Total	1.00 / 1.00	

Question Explanation

```
fit1 <- lm(mpg ~ factor(cyl), data = mtcars)
fit2 <- lm(mpg ~ factor(cyl) + wt, data = mtcars)
summary(fit1)$coef
```

```
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)    26.664      0.9718  27.437 2.688e-22
## factor(cyl)6   -6.921      1.5583  -4.441 1.195e-04
## factor(cyl)8  -11.564      1.2986  -8.905 8.568e-10
```

```
summary(fit2)$coef
```

```
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)    33.991      1.8878  18.006 6.257e-17
## factor(cyl)6   -4.256      1.3861  -3.070 4.718e-03
## factor(cyl)8   -6.071      1.6523  -3.674 9.992e-04
## wt             -3.206      0.7539  -4.252 2.130e-04
```

```
c(summary(fit1)$coef[3, 1], summary(fit2)$coef[3, 1])
```

```
## [1] -11.564 -6.071
```

Question 3

Consider the `mtcars` data set. Fit a model with mpg as the outcome that considers number of cylinders as a factor variable and weight as confounder. Now fit a second model with mpg as the outcome model that considers the interaction between number of cylinders (as a factor variable) and weight. Give the P-value for the likelihood ratio test comparing the two models and suggest a model using 0.05 as a type I error rate significance benchmark.

Your Answer

Score

Explanation

- ☐ The P-value is larger than 0.05. So, according to our criterion, we would fail to reject, which suggests that the interaction terms is necessary.
- ☐ The P-value is small (less than 0.05). So, according to our criterion, we reject, which suggests that the interaction term is necessary

☐ The P-value is small (less than 0.05). Thus it is surely true that there is no interaction term in the true model.

☒ The P-value is larger than 0.05. So, according to our criterion, we would fail to reject, which suggests that the interaction terms may not be necessary.

✓ 1.00

☐ The P-value is small (less than 0.05). Thus it is surely true that there is an interaction term in the true model.

☐ The P-value is small (less than 0.05). So, according to our criterion, we reject, which suggests that the interaction term is not necessary.

Total

1.00 /

1.00

Question Explanation

```
fit1 <- lm(mpg ~ factor(cyl) + wt, data = mtcars)
fit2 <- lm(mpg ~ factor(cyl) * wt, data = mtcars)
summary(fit1)$coef
```

```
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    33.991     1.8878  18.006 6.257e-17
## factor(cyl)6   -4.256     1.3861   -3.070 4.718e-03
## factor(cyl)8   -6.071     1.6523   -3.674 9.992e-04
## wt              -3.206     0.7539   -4.252 2.130e-04
```

```
summary(fit2)$coef
```

```
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    39.571     3.194  12.3895 2.058e-12
## factor(cyl)6   -11.162     9.355  -1.1932 2.436e-01
## factor(cyl)8   -15.703     4.839  -3.2448 3.223e-03
## wt              -5.647     1.359  -4.1538 3.128e-04
## factor(cyl)6:wt    2.867     3.117   0.9197 3.662e-01
## factor(cyl)8:wt    3.455     1.627   2.1229 4.344e-02
```

```
anova(fit1, fit2)
```

```
## Analysis of Variance Table
```

```
##
## Model 1: mpg ~ factor(cyl) + wt
## Model 2: mpg ~ factor(cyl) * wt
##   Res.Df RSS Df Sum of Sq    F Pr(>F)
## 1      28 183
## 2      26 156  2      27.2 2.27  0.12
```

Question 4

Consider the `mtcars` data set. Fit a model with mpg as the outcome that includes number of cylinders as a factor variable and weight included in the model as

```
lm(mpg ~ I(wt * 0.5) + factor(cyl), data = mtcars)
```

How is the wt coefficient interpreted?

Your Answer	Score	Explanation
<input type="radio"/> The estimated expected change in MPG per half ton increase in weight for the average number of cylinders.		
<input type="radio"/> The estimated expected change in MPG per half ton increase in weight for for a specific number of cylinders (4, 6, 8).		
<input checked="" type="radio"/> The estimated expected change in MPG per one ton increase in weight for a specific number of cylinders (4, 6, 8).	✓ 1.00	
<input type="radio"/> The estimated expected change in MPG per half ton increase in weight.		
<input type="radio"/> The estimated expected change in MPG per one ton increase in weight.		
Total	1.00 / 1.00	

Question 5

Consider the following data set

```
x <- c(0.586, 0.166, -0.042, -0.614, 11.72)
y <- c(0.549, -0.026, -0.127, -0.751, 1.344)
```

Give the hat diagonal for the most influential point

Your Answer	Score	Explanation
<input type="radio"/> 0.2287		
<input type="radio"/> 0.2025		
<input checked="" type="radio"/> 0.9946	✓ 1.00	
<input type="radio"/> 0.2804		
Total	1.00 / 1.00	

Question Explanation

```
influence(lm(y ~ x))$hat
```

```
##      1      2      3      4      5
## 0.2287 0.2438 0.2525 0.2804 0.9946
```

```
## showing how it's actually calculated
xm <- cbind(1, x)
diag(xm %*% solve(t(xm) %*% xm) %*% t(xm))
```

```
## [1] 0.2287 0.2438 0.2525 0.2804 0.9946
```

Question 6

Consider the following data set

```
x <- c(0.586, 0.166, -0.042, -0.614, 11.72)
y <- c(0.549, -0.026, -0.127, -0.751, 1.344)
```

Give the slope dfbeta for the point with the highest hat value.

Your Answer	Score	Explanation
<input checked="" type="radio"/> -134	1.00	
<input type="radio"/> 0.673		
<input type="radio"/> -0.378		
<input type="radio"/> -.00134		
Total	1.00 / 1.00	

Question Explanation

```
influence.measures(lm(y ~ x))
```

```
## Influence measures of
##   lm(formula = y ~ x) :
##
##      dfb.1_      dfb.x      dffit cov.r   cook.d   hat inf
## 1  1.0621 -3.78e-01   1.0679 0.341 2.93e-01 0.229  *
## 2  0.0675 -2.86e-02   0.0675 2.934 3.39e-03 0.244
## 3 -0.0174 7.92e-03  -0.0174 3.007 2.26e-04 0.253  *
## 4 -1.2496 6.73e-01  -1.2557 0.342 3.91e-01 0.280  *
## 5  0.2043 -1.34e+02 -149.7204 0.107 2.70e+02 0.995  *
```

Question 7

Consider a regression relationship between Y and X with and without adjustment for a third variable Z. Which of the following is true about comparing the regression coefficient between Y and X with and without adjustment for Z.

Your Answer**Score****Explanation**

- ☒ It is possible for the coefficient to reverse sign after adjustment. For example, it can be strongly significant and positive before adjustment and strongly significant and negative after adjustment.
- ☐ For the the coefficient to change sign, there must be a significant interaction term.
- ☐ Adjusting for another variable can only attenuate the coefficient toward zero. It can't materially change sign.
- ☐ The coefficient can't change sign after adjustment, except for slight numerical pathological cases.

✓ 1.00

Total

1.00 /

1.00

Question Explanation

See lecture 02_03 for various examples.