**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.

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| **Your Answer** |  | **Score** | **Explanation** |
| -3.206 |  |  |  |
| -6.071 | Correct | 1.00 |  |
| -4.256 |  |  |  |
| 33.991 |  |  |  |
| Total |  | 1.00 / 1.00 |  |

**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?.

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

**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.

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| **Your Answer** |  | **Score** | **Explanation** |
| 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 small (less than 0.05). Thus it is surely true that there is an 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 is necessary. | Inorrect | 0.00 |  |
| 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. |  |  |  |
| 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 larger than 0.05. So, according to our criterion, we would fail to reject, which suggests that the interaction terms may not be necessary. |  |  |  |
| Total |  | 0.00 / 1.00 |  |

**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 inlcuded in the model as

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

How is the wt coefficient interpretted?

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| **Your Answer** |  | **Score** | **Explanation** |
| The estimated expected change in MPG per half ton increase in weight for for a specific number of cylinders (4, 6, 8). |  |  |  |
| The estimated expected change in MPG per one ton increase in weight for a specific number of cylinders (4, 6, 8). |  |  |  |
| The estimated expected change in MPG per half ton increase in weight. | Inorrect | 0.00 |  |
| The estimated expected change in MPG per one ton increase in weight. |  |  |  |
| The estimated expected change in MPG per half ton increase in weight for the average number of cylinders. |  |  |  |
| Total |  | 0.00 / 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

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| **Your Answer** |  | **Score** | **Explanation** |
| 0.2804 |  |  |  |
| 0.2287 |  |  |  |
| 0.2025 |  |  |  |
| 0.9946 | Correct | 1.00 |  |
| Total |  | 1.00 / 1.00 |  |

**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.

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| **Your Answer** |  | **Score** | **Explanation** |
| 0.673 |  |  |  |
| -134 | Correct | 1.00 |  |
| -0.378 |  |  |  |
| -.00134 |  |  |  |
| Total |  | 1.00 / 1.00 |  |

**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.

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| **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. | Correct | 1.00 |  |
| For the the coefficient to change sign, there must be a significant interaction term. |  |  |  |
| The coefficient can't change sign after adjustment, except for slight numerical pathological cases. |  |  |  |
| Adjusting for another variable can only attenuate the coefficient toward zero. It can't materially change sign. |  |  |  |
| Total |  | 1.00 / 1.00 |  |