

0.1 Example 1

Are a person's brain size and body size predictive of his or her intelligence? Interested in answering the above research question, some researchers collected the following data on a sample of $n = 38$ college students:

- Response (y): Performance IQ scores (PIQ) from the revised Wechsler Adult Intelligence Scale. This variable served as the investigator's measure of the individual's intelligence.
- Potential predictor (x1): Brain size based on the count obtained from MRI scans (given as count/10,000).
- Potential predictor (x2): Height in inches.
- Potential predictor (x3): Weight in pounds.

```
##   PIQ  Brain Height Weight
## 1 124  81.69   64.5   118
## 2 150 103.84   73.3   143
## 3 128  96.54   68.8   172
## 4 134  95.15   65.0   147
## 5 110  92.88   69.0   146
## 6 131  99.13   64.5   138
```

Here is the output of the multiple regression:

```
##
## Call:
## lm(formula = PIQ ~ Brain + Height + Weight, data = data.brain)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -32.74 -12.09  -3.84   14.17   51.69
##
## Coefficients:
```

```
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.114e+02  6.297e+01   1.768 0.085979 .
## Brain        2.060e+00  5.634e-01   3.657 0.000856 ***
## Height      -2.732e+00  1.229e+00  -2.222 0.033034 *
## Weight       5.599e-04  1.971e-01   0.003 0.997750
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 19.79 on 34 degrees of freedom
## Multiple R-squared:  0.2949, Adjusted R-squared:  0.2327
## F-statistic: 4.741 on 3 and 34 DF,  p-value: 0.007215
```

1. Write down multiple regression equation
2. Which, if any, predictors brain size, height, or weight explain some of the variation in intelligence scores?
3. What is the effect of brain size on PIQ, after taking into account height and weight?
4. What is the PIQ of an individual with a brain size 90, height 65 and weight 120?
5. What is the PIQ of an individual with a brain size 120, height 70 and weight 144?

0.2 Example 2

Is a baby's birth weight related to the mother's smoking during pregnancy? Researchers interested in answering the above research question collected the following data on a random sample of $n = 32$ births:

- Response (y): birth weight (Weight) in grams of baby
- Potential predictor (x1): Smoking status of mother (yes or no)

- Potential predictor (x2): length of gestation (Gest) in weeks

The distinguishing feature of this data set is that one of the predictor variables `Smoking` is a qualitative predictor. To be more precise, smoking is a "binary variable" with only two possible values (yes or no). The other predictor variable (`Gest`) is, of course, quantitative.

```
##      Wgt Gest Smoke
## 1 2940   38   yes
## 2 3130   38    no
## 3 2420   36   yes
## 4 2450   34    no
## 5 2760   39   yes
## 6 2440   35   yes
```

```
##
## Call:
## lm(formula = Wgt ~ Gest + Smoke, data = data.smoke)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -223.693  -92.063   -9.365   79.663  197.507
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2389.573    349.206  -6.843 1.63e-07 ***
## Gest         143.100     9.128   15.677 1.07e-15 ***
## Smokeyes     -244.544    41.982   -5.825 2.58e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 115.5 on 29 degrees of freedom
```

```
## Multiple R-squared:  0.8964, Adjusted R-squared:  0.8892  
## F-statistic: 125.4 on 2 and 29 DF,  p-value: 5.289e-15
```

1. Write down multiple regression equation
2. Is baby's birth weight related to smoking during pregnancy, after taking into account length of gestation?
3. How is birth weight related to gestation, after taking into account a mother's smoking status?
4. What is the weight given NO smoking during pregnancy and 35 week of gestation?
5. What is the weight given smoking during pregnancy and 35 week of gestation?