Problem Set 1

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1 Getting Started with R

1.1 Print inline hello world

```
print('hello world', quote=FALSE)

## [1] hello world
```

1.2 Create a vector y

```
y <- c(100,200,300,400,500)
print(y)

## [1] 100 200 300 400 500
```

1.3 Create normal matrix x with mean 100 and variance 10

```
set.seed(20866)
x <- matrix(rnorm(5*5, mean = 100, sd = sqrt(10)), 5, 5)
print(x)

##           [,1]      [,2]      [,3]      [,4]      [,5]
## [1,]  97.35727 103.97484 103.36721 105.37185 103.32458
## [2,]  99.13215  95.49546 100.97945  99.76002 102.88952
## [3,]  97.39839  96.15575  99.58361  97.97385 100.40162
## [4,]  99.85983  98.78686 103.37817 102.47731 103.00107
## [5,] 102.50208  99.03253  97.78627  96.32905  99.71611
```

1.4 Calculate and display (X prime X) inverse

```
xprime <- t(x)
xAndPrimeMultiplied <- xprime %*% x
xSolution <- solve(xAndPrimeMultiplied)
print(xSolution)
```

```
##            [,1]       [,2]       [,3]       [,4]       [,5]
## [1,]  0.2771095 -0.2351883 -0.3306888  0.5802069 -0.2859665
## [2,] -0.2351883  0.2402567  0.3475531 -0.5498854  0.1936152
## [3,] -0.3306888  0.3475531  1.2137628 -1.0664347 -0.1672556
## [4,]  0.5802069 -0.5498854 -1.0664347  1.4540417 -0.4079109
## [5,] -0.2859665  0.1936152 -0.1672556 -0.4079109  0.6589055
```

```
crossProductX <- crossprod(x)
xSolution2 <- solve(crossProductX)
print(xSolution2)
```

```
##            [,1]       [,2]       [,3]       [,4]       [,5]
## [1,]  0.2771095 -0.2351883 -0.3306888  0.5802069 -0.2859665
## [2,] -0.2351883  0.2402567  0.3475531 -0.5498854  0.1936152
## [3,] -0.3306888  0.3475531  1.2137628 -1.0664347 -0.1672556
## [4,]  0.5802069 -0.5498854 -1.0664347  1.4540417 -0.4079109
## [5,] -0.2859665  0.1936152 -0.1672556 -0.4079109  0.6589055
```

1.5 Calculate sum of entries in y

```
sumYEntries <- sum(y)
print(sumYEntries)
```

```
## [1] 1500
```

1.6 Calculate row sums of X

```
xRowSums <- rowSums(x)
print(xRowSums)
```

```
## [1] 513.3957 498.2566 491.5132 507.5032 495.3660
```

1.7 Return maximum value in X

```r
xMax <- max(x)
print(xMax)
```

```
## [1] 105.3718
```

1.8 Replace third row of X with zeroes

```r
newMatrix <- x
z <- c(0, 0, 0, 0, 0)
newMatrix[3, ]<- z
print(newMatrix)
```

```
##           [,1]      [,2]      [,3]      [,4]      [,5]
## [1,]  97.35727 103.97484 103.36721 105.37185 103.32458
## [2,]  99.13215  95.49546 100.97945  99.76002 102.88952
## [3,]   0.00000   0.00000   0.00000   0.00000   0.00000
## [4,]  99.85983  98.78686 103.37817 102.47731 103.00107
## [5,] 102.50208  99.03253  97.78627  96.32905  99.71611
```

2 Function and Loops in R

2.1 Use for loop to print all numbers between 1 and 100 which are not multiples of 3 or 4

```r
for (n in 1:100)
  if (((n%%3) != 0) & ((n%%4) != 0)){
    print(n)
  }
```

```
## [1] 1
## [1] 2
## [1] 5
## [1] 7
## [1] 10
## [1] 11
## [1] 13
## [1] 14
## [1] 17
## [1] 19
## [1] 22
## [1] 23
## [1] 25
```

```
## [1] 26
## [1] 29
## [1] 31
## [1] 34
## [1] 35
## [1] 37
## [1] 38
## [1] 41
## [1] 43
## [1] 46
## [1] 47
## [1] 49
## [1] 50
## [1] 53
## [1] 55
## [1] 58
## [1] 59
## [1] 61
## [1] 62
## [1] 65
## [1] 67
## [1] 70
## [1] 71
## [1] 73
## [1] 74
## [1] 77
## [1] 79
## [1] 82
## [1] 83
## [1] 85
## [1] 86
## [1] 89
## [1] 91
## [1] 94
## [1] 95
## [1] 97
## [1] 98
```

2.2 Write function for fibonacci numbers less than input

```
fibfunction <- function(x){

  Fib1 <- 1
```

```
  Fib2 <- 1
  Fibonacci <- Fib1

    while (Fib2 < x){
      Fibonacci <- c(Fibonacci, Fib2)
      oldFib2 <- Fib2
      Fib2 <- Fib1 + Fib2
      Fib1 <- oldFib2
    }

  print(Fibonacci)
}

fibfunction(1000)
```

```
##  [1]   1   1   2   3   5   8  13  21  34  55  89 144 233 377 610 987
```

3 Basic Regression in R

3.1 Calculate the correlation between X and Y

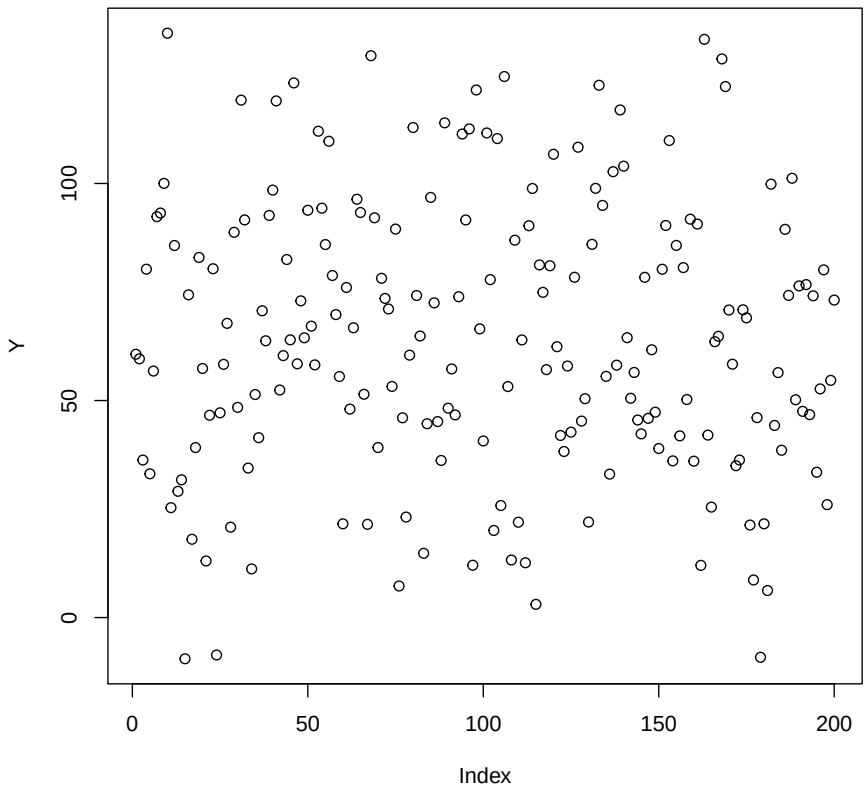
```
rm(list=ls())
set.seed(21410)

n <- 200
X <- rnorm(n,20,10)
eps <- rnorm(n,0,4)
beta <- 3.1
const <- 2
Y <- const + (X * beta) + eps
correlation <- cor(X,Y)
print(correlation)
```

```
## [1] 0.9909514
```

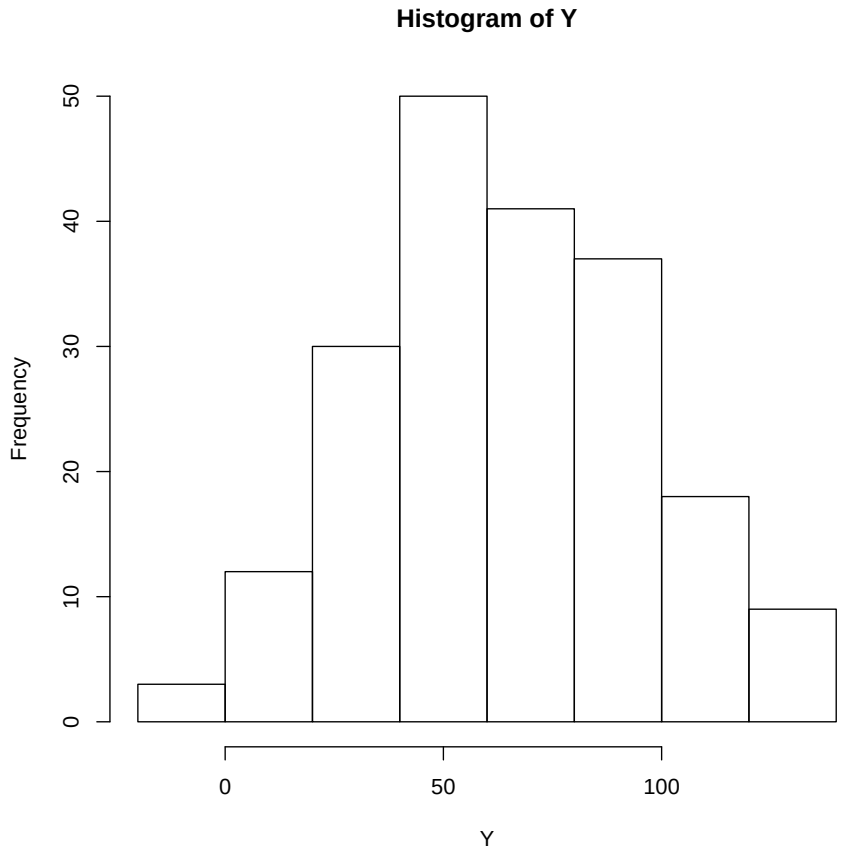
3.2 Plot the Y values for each individual (Y on the y-axis, 1-200 on the x-axis)

```
plot(Y)
```



3.3 Plot a histogram of Y

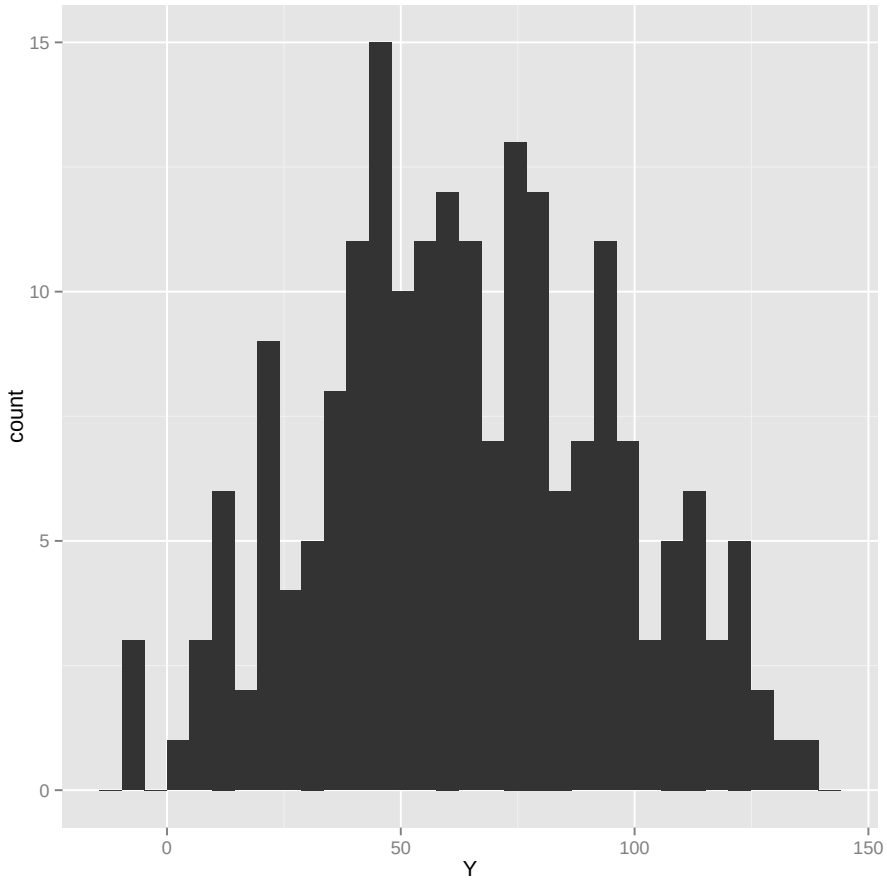
```
hist(Y)
```



3.4 Plot a histogram of Y using the packages ggplot2 or ggvis

```
library(ggplot2)
qplot(Y, geom="histogram")

## stat_bin:  binwidth defaulted to range/30.  Use 'binwidth = x' to
adjust this.
```



3.5 Use your simulated data to run the regression of Y on X using the lm() command

```
fit <- lm(Y ~ X)
fit

##
## Call:
## lm(formula = Y ~ X)
##
## Coefficients:
## (Intercept)            X
##       1.707        3.100
```

3.6 Make a latex table of the regression results using xtable() or stargazer()

```
library(xtable)
xtable(fit)

## % latex table generated in R 3.1.3 by xtable 1.7-4 package
## % Wed Apr  8 16:03:16 2015
## \begin{table}[ht]
## \centering
## \begin{tabular}{rrrrr}
##   \hline
##  & Estimate & Std. Error & t value & Pr($>$$|$t$|$) \\
##   \hline
## (Intercept) & 1.7073 & 0.6719 & 2.54 & 0.0118 \\
##   X & 3.1004 & 0.0298 & 103.89 & 0.0000 \\
##    \hline
## \end{tabular}
## \end{table}
```

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.7073	0.6719	2.54	0.0118
X	3.1004	0.0298	103.89	0.0000

4 Getting Started with Latex

4.1 Insert an image off the internet, preferbly a kitten

4.2 Display matrix x and vector y above in Latex

```r
options(digits = 0)
vectorX <- matrix(X, 200)
vectorY <- matrix(Y, 200)
print(xtable(vectorX))
```

```
## % latex table generated in R 3.1.3 by xtable 1.7-4 package
## % Wed Apr  8 16:03:16 2015
## \begin{table}[ht]
## \centering
## \begin{tabular}{rr}
##   \hline
##  & x \\
##   \hline
## 1 & 19.28 \\
##   2 & 20.29 \\
##   3 & 10.61 \\
##   4 & 26.78 \\
##   5 & 10.39 \\
##   6 & 18.78 \\
##   7 & 27.80 \\
##   8 & 30.11 \\
##   9 & 30.23 \\
##   10 & 42.14 \\
##   11 & 8.72 \\
##   12 & 27.32 \\
##   13 & 11.20 \\
##   14 & 12.73 \\
##   15 & -6.35 \\
##   16 & 22.93 \\
##   17 & 3.31 \\
##   18 & 10.76 \\
##   19 & 26.13 \\
##   20 & 19.30 \\
##   21 & 2.65 \\
##   22 & 15.50 \\
##   23 & 25.89 \\
##   24 & -4.22 \\
##   25 & 14.45 \\
##   26 & 19.48 \\
##   27 & 21.27 \\
##   28 & 4.77 \\
##   29 & 28.97 \\
##   30 & 15.72 \\
##   31 & 37.69 \\
##   32 & 27.56 \\
##   33 & 11.44 \\
```

```
##   34 & 2.81 \\
##   35 & 16.42 \\
##   36 & 12.45 \\
##   37 & 22.49 \\
##   38 & 21.90 \\
##   39 & 30.44 \\
##   40 & 29.00 \\
##   41 & 36.09 \\
##   42 & 17.26 \\
##   43 & 20.36 \\
##   44 & 25.38 \\
##   45 & 18.86 \\
##   46 & 40.30 \\
##   47 & 18.54 \\
##   48 & 23.41 \\
##   49 & 20.49 \\
##   50 & 28.62 \\
##   51 & 22.72 \\
##   52 & 17.82 \\
##   53 & 34.81 \\
##   54 & 30.40 \\
##   55 & 26.50 \\
##   56 & 34.24 \\
##   57 & 24.03 \\
##   58 & 21.83 \\
##   59 & 15.31 \\
##   60 & 8.89 \\
##   61 & 26.48 \\
##   62 & 15.04 \\
##   63 & 22.78 \\
##   64 & 30.69 \\
##   65 & 28.48 \\
##   66 & 17.03 \\
##   67 & 6.63 \\
##   68 & 43.62 \\
##   69 & 27.51 \\
##   70 & 13.21 \\
##   71 & 23.76 \\
##   72 & 22.01 \\
##   73 & 18.45 \\
##   74 & 15.76 \\
##   75 & 26.30 \\
##   76 & 2.99 \\
##   77 & 13.72 \\
##   78 & 7.10 \\
```

```
##   79 & 19.47 \\
##   80 & 34.25 \\
##   81 & 22.78 \\
##   82 & 19.64 \\
##   83 & 4.39 \\
##   84 & 16.26 \\
##   85 & 33.32 \\
##   86 & 22.48 \\
##   87 & 16.61 \\
##   88 & 11.11 \\
##   89 & 33.98 \\
##   90 & 16.28 \\
##   91 & 18.61 \\
##   92 & 12.99 \\
##   93 & 22.61 \\
##   94 & 34.33 \\
##   95 & 26.37 \\
##   96 & 36.26 \\
##   97 & 3.47 \\
##   98 & 39.00 \\
##   99 & 19.28 \\
##   100 & 14.54 \\
##   101 & 35.75 \\
##   102 & 25.61 \\
##   103 & 4.52 \\
##   104 & 36.42 \\
##   105 & 7.61 \\
##   106 & 38.23 \\
##   107 & 16.69 \\
##   108 & 5.43 \\
##   109 & 27.16 \\
##   110 & 5.10 \\
##   111 & 20.92 \\
##   112 & 4.99 \\
##   113 & 29.74 \\
##   114 & 32.62 \\
##   115 & 1.12 \\
##   116 & 24.97 \\
##   117 & 23.73 \\
##   118 & 17.60 \\
##   119 & 24.72 \\
##   120 & 31.13 \\
##   121 & 19.22 \\
##   122 & 12.89 \\
##   123 & 10.50 \\
```

```
##   124 & 16.55 \\
##   125 & 16.19 \\
##   126 & 25.91 \\
##   127 & 35.52 \\
##   128 & 13.12 \\
##   129 & 17.54 \\
##   130 & 7.02 \\
##   131 & 26.61 \\
##   132 & 30.11 \\
##   133 & 38.59 \\
##   134 & 33.58 \\
##   135 & 18.20 \\
##   136 & 10.16 \\
##   137 & 31.30 \\
##   138 & 18.13 \\
##   139 & 38.34 \\
##   140 & 35.24 \\
##   141 & 21.82 \\
##   142 & 16.29 \\
##   143 & 18.59 \\
##   144 & 12.48 \\
##   145 & 13.14 \\
##   146 & 25.21 \\
##   147 & 13.99 \\
##   148 & 20.30 \\
##   149 & 15.11 \\
##   150 & 10.76 \\
##   151 & 23.51 \\
##   152 & 26.69 \\
##   153 & 34.52 \\
##   154 & 11.65 \\
##   155 & 27.86 \\
##   156 & 13.93 \\
##   157 & 23.35 \\
##   158 & 14.92 \\
##   159 & 28.78 \\
##   160 & 10.30 \\
##   161 & 27.27 \\
##   162 & 1.87 \\
##   163 & 39.19 \\
##   164 & 16.60 \\
##   165 & 8.58 \\
##   166 & 20.31 \\
##   167 & 18.60 \\
##   168 & 42.25 \\
```

```
##   169 & 38.71 \\
##   170 & 22.05 \\
##   171 & 20.39 \\
##   172 & 9.40 \\
##   173 & 11.74 \\
##   174 & 21.46 \\
##   175 & 18.49 \\
##   176 & 8.03 \\
##   177 & 1.80 \\
##   178 & 13.61 \\
##   179 & -2.64 \\
##   180 & 5.54 \\
##   181 & 2.73 \\
##   182 & 32.01 \\
##   183 & 15.49 \\
##   184 & 16.82 \\
##   185 & 8.76 \\
##   186 & 28.46 \\
##   187 & 24.50 \\
##   188 & 31.18 \\
##   189 & 16.90 \\
##   190 & 23.92 \\
##   191 & 16.50 \\
##   192 & 21.94 \\
##   193 & 13.36 \\
##   194 & 24.29 \\
##   195 & 11.37 \\
##   196 & 16.85 \\
##   197 & 24.38 \\
##   198 & 8.65 \\
##   199 & 14.35 \\
##   200 & 23.08 \\
##    \hline
## \end{tabular}
## \end{table}
```

```
print(xtable(vectorY))
```

```
## % latex table generated in R 3.1.3 by xtable 1.7-4 package
## % Wed Apr  8 16:03:17 2015
## \begin{table}[ht]
## \centering
## \begin{tabular}{rr}
##   \hline
##  & x \\
##   \hline
```

```
## 1 & 60.66 \\
##   2 & 59.60 \\
##   3 & 36.29 \\
##   4 & 80.26 \\
##   5 & 33.12 \\
##   6 & 56.79 \\
##   7 & 92.35 \\
##   8 & 93.19 \\
##   9 & 100.02 \\
##   10 & 134.62 \\
##   11 & 25.32 \\
##   12 & 85.71 \\
##   13 & 29.09 \\
##   14 & 31.73 \\
##   15 & -9.50 \\
##   16 & 74.35 \\
##   17 & 18.04 \\
##   18 & 39.16 \\
##   19 & 82.96 \\
##   20 & 57.38 \\
##   21 & 13.03 \\
##   22 & 46.60 \\
##   23 & 80.36 \\
##   24 & -8.62 \\
##   25 & 47.17 \\
##   26 & 58.33 \\
##   27 & 67.78 \\
##   28 & 20.82 \\
##   29 & 88.76 \\
##   30 & 48.42 \\
##   31 & 119.20 \\
##   32 & 91.60 \\
##   33 & 34.44 \\
##   34 & 11.21 \\
##   35 & 51.39 \\
##   36 & 41.44 \\
##   37 & 70.67 \\
##   38 & 63.76 \\
##   39 & 92.64 \\
##   40 & 98.48 \\
##   41 & 119.02 \\
##   42 & 52.42 \\
##   43 & 60.34 \\
##   44 & 82.48 \\
##   45 & 63.98 \\
```

```
##   46 & 123.16 \\
##   47 & 58.46 \\
##   48 & 72.96 \\
##   49 & 64.45 \\
##   50 & 93.83 \\
##   51 & 67.13 \\
##   52 & 58.21 \\
##   53 & 112.04 \\
##   54 & 94.31 \\
##   55 & 85.93 \\
##   56 & 109.73 \\
##   57 & 78.80 \\
##   58 & 69.80 \\
##   59 & 55.53 \\
##   60 & 21.59 \\
##   61 & 76.04 \\
##   62 & 48.02 \\
##   63 & 66.76 \\
##   64 & 96.37 \\
##   65 & 93.31 \\
##   66 & 51.44 \\
##   67 & 21.48 \\
##   68 & 129.43 \\
##   69 & 92.10 \\
##   70 & 39.17 \\
##   71 & 78.16 \\
##   72 & 73.52 \\
##   73 & 71.08 \\
##   74 & 53.24 \\
##   75 & 89.50 \\
##   76 & 7.27 \\
##   77 & 46.02 \\
##   78 & 23.15 \\
##   79 & 60.45 \\
##   80 & 112.89 \\
##   81 & 74.19 \\
##   82 & 64.86 \\
##   83 & 14.80 \\
##   84 & 44.65 \\
##   85 & 96.79 \\
##   86 & 72.49 \\
##   87 & 45.15 \\
##   88 & 36.19 \\
##   89 & 113.96 \\
##   90 & 48.23 \\
```

```
##   91 & 57.27 \\
##   92 & 46.67 \\
##   93 & 73.91 \\
##   94 & 111.39 \\
##   95 & 91.59 \\
##   96 & 112.58 \\
##   97 & 12.06 \\
##   98 & 121.54 \\
##   99 & 66.50 \\
##   100 & 40.69 \\
##   101 & 111.63 \\
##   102 & 77.85 \\
##   103 & 20.07 \\
##   104 & 110.34 \\
##   105 & 25.81 \\
##   106 & 124.64 \\
##   107 & 53.21 \\
##   108 & 13.26 \\
##   109 & 86.93 \\
##   110 & 21.96 \\
##   111 & 63.96 \\
##   112 & 12.62 \\
##   113 & 90.27 \\
##   114 & 98.85 \\
##   115 & 3.05 \\
##   116 & 81.24 \\
##   117 & 74.92 \\
##   118 & 57.12 \\
##   119 & 81.04 \\
##   120 & 106.73 \\
##   121 & 62.40 \\
##   122 & 41.95 \\
##   123 & 38.26 \\
##   124 & 57.94 \\
##   125 & 42.72 \\
##   126 & 78.39 \\
##   127 & 108.35 \\
##   128 & 45.27 \\
##   129 & 50.42 \\
##   130 & 22.01 \\
##   131 & 85.98 \\
##   132 & 98.88 \\
##   133 & 122.62 \\
##   134 & 94.94 \\
##   135 & 55.56 \\
```

```
##   136 & 33.05 \\
##   137 & 102.72 \\
##   138 & 58.15 \\
##   139 & 116.94 \\
##   140 & 103.98 \\
##   141 & 64.47 \\
##   142 & 50.52 \\
##   143 & 56.47 \\
##   144 & 45.51 \\
##   145 & 42.32 \\
##   146 & 78.38 \\
##   147 & 45.89 \\
##   148 & 61.69 \\
##   149 & 47.31 \\
##   150 & 38.94 \\
##   151 & 80.25 \\
##   152 & 90.33 \\
##   153 & 109.90 \\
##   154 & 36.10 \\
##   155 & 85.73 \\
##   156 & 41.86 \\
##   157 & 80.62 \\
##   158 & 50.23 \\
##   159 & 91.78 \\
##   160 & 36.02 \\
##   161 & 90.65 \\
##   162 & 12.03 \\
##   163 & 133.20 \\
##   164 & 42.03 \\
##   165 & 25.45 \\
##   166 & 63.55 \\
##   167 & 64.80 \\
##   168 & 128.69 \\
##   169 & 122.33 \\
##   170 & 70.85 \\
##   171 & 58.36 \\
##   172 & 34.98 \\
##   173 & 36.29 \\
##   174 & 70.90 \\
##   175 & 69.04 \\
##   176 & 21.31 \\
##   177 & 8.66 \\
##   178 & 46.06 \\
##   179 & -9.15 \\
##   180 & 21.60 \\
```

```
##   181 & 6.23 \\
##   182 & 99.84 \\
##   183 & 44.26 \\
##   184 & 56.43 \\
##   185 & 38.55 \\
##   186 & 89.43 \\
##   187 & 74.22 \\
##   188 & 101.20 \\
##   189 & 50.18 \\
##   190 & 76.40 \\
##   191 & 47.51 \\
##   192 & 76.70 \\
##   193 & 46.75 \\
##   194 & 74.13 \\
##   195 & 33.48 \\
##   196 & 52.68 \\
##   197 & 80.10 \\
##   198 & 26.02 \\
##   199 & 54.65 \\
##   200 & 73.14 \\
##    \hline
## \end{tabular}
## \end{table}
```