Name - NetID

Homework 1

As a first step, I would encourage you to knit this file as a pdf (without making any changes besides deleting the text and code above) to ensure you are able to.

Homework Instructions

For questions that require code, please create a code chunk directly below the question and type your code there. Your knitted pdf will show both your code and your output. You are encouraged to knit your file as you work to check that your coding and formatting is done so appropriately.

For written responses or multiple choice questions, please bold your (selected) answer.

Grading Details

All questions will be graded full credit (1 point), half credit (0.5 point) or no credit (0 points).

Full credit responses should have the correct response and the appropriate code. Half credit responses will have a reasonable attempt (typically no more than one small error or oversight), and no credit responses will be blank or attempts or attempts with at least one significant error.

Exercise 1

```
# starter
x = 1:100
```

Calculate

$$\sum_{i=1}^{n} \ln(x_i).$$

That is, sum the log of each element of `x`.

Hint: The simplest way to do this is with two functions, one nested within the other.

```
# solution
sum(log(x))
```

```
## [1] 363.7394
```

Exercise 2

Create a vector that spans the range 12 to 15.4, and that goes by intervals of 0.2. Name this vector `h`

Please be sure to also run `h` at the end so that your vector is printed.

```
# solution
h=seq(12,15.4,0.2)
h
```

```
##  [1] 12.0 12.2 12.4 12.6 12.8 13.0 13.2 13.4 13.6 13.8 14.0 14.2 14.4 14.6 14.8
## [16] 15.0 15.2 15.4
```

Exercise 3

```
#starter
labels = c("A","B","C")
```

Create a new vector named `full_labels` that repeats the sequence `labels` until this new vector has a length of 90

Print `full_labels`

```
#solution
full_labels=rep(labels,times = 30)
full_labels
```

```
##  [1] "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A"
## [20] "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B"
## [39] "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C"
## [58] "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A"
## [77] "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C" "A" "B" "C"
```

Exercise 4

```
# starter
x = 1:100
```

Create a new vector `y`, which adds 5 to the elements stored in odd indices of `x` and subtracts 10 from the elements stored even indices of `x`.

Hint: Try creating a second vector and then take advantage of vectorized operations to complete this arithmetic.

Finally, print `y`

```
#solution
z=c(5,-10)
a=x+z
y=a[1:100]
y
```

```
##   [1]   6  -8   8  -6  10  -4  12  -2  14   0  16   2  18   4  20   6  22   8
##  [19]  24  10  26  12  28  14  30  16  32  18  34  20  36  22  38  24  40  26
##  [37]  42  28  44  30  46  32  48  34  50  36  52  38  54  40  56  42  58  44
##  [55]  60  46  62  48  64  50  66  52  68  54  70  56  72  58  74  60  76  62
##  [73]  78  64  80  66  82  68  84  70  86  72  88  74  90  76  92  78  94  80
##  [91]  96  82  98  84 100  86 102  88 104  90
```

Exercise 5

Which of the following objects in `R` is technically a vector, but each entry of that vector is a set of one or more entries, and each element can be of a different type?

*Please **bold** your answer*

A Matrix

A Function

A List

A Data Frame

A Tibble

Exercise 6

```r
# starter
set.seed(42)
data = data.frame(
  x = rep("A",8),
  y = c(1, 1, 2, 3, 5, 8, 13, 21),
  z = sample(8)
)
```

The above code block creates a data frame, stored as the variable `data`.

Extract the third entry of the vector `y`.

Hint: There is more than one way to do this. Any method that produces the correct result is fine.

```r
# solution
data[3,2]
```

```
## [1] 2
```

Exercise 7

```r
# starter
set.seed(42)
a = rnorm(100, mean = 0, sd = 10)
```

Write a function called `f` that has a single argument `input`. We want this function to input a vector (that may have a mixture of positive and negative values) and produce a vector where all negative elements are replaced with 0.

Hint: The `ifelse()` function could be useful here.

Write and save your function, then run your function with vector `a` as your input and save the result to a new variable named `x_pos`, and then extract the first five elements of `x_pos`

```
#solution
ex7 <- function(input){
  ifelse(input > 0, input, 0)}

z=ex7(a)
z[1:5]
```

```
## [1] 13.709584  0.000000  3.631284  6.328626  4.042683
```

Exercise 8

Create three vectors as follows. Each should have a length of 30.

x1: Each element should be the value 1 x2: The first 30 square numbers, starting from 1 (so 1, 4, 9, etc.) x3: A sequence running from 2 to 60 by 2's.

Then create a new vector named y, such that each entry of y is the sum of the entries of x1, x2, and x3 for that same position.

Print y

```
# solution
x1=rep(1,times=30)
x=1:30
x2=x^2
x3=seq(2,60,2)
y=x1+x2+x3
y
```

```
##  [1]   4   9  16  25  36  49  64  81 100 121 144 169 196 225 256 289 324 361 400
## [20] 441 484 529 576 625 676 729 784 841 900 961
```

Exercise 9

(Continued from Exercise 8) Create a matrix X with columns x1, x2, and x3.

Hint: Use the column bind function.

Report the sum of the elements in row 17 of this matrix.

```
# solution
X=cbind(x1,x2,x3)
sum=rowSums(X)
sum[17]
```

```
## [1] 324
```

Exercise 10

If you do not have this already, run this code to install ggplot2 (remove the # first)

```
#starter_0
#install.packages("ggplot2")
```

```
#starter
library(ggplot2)
mpg
```

```
## # A tibble: 234 x 11
##    manufacturer model    displ  year   cyl trans   drv     cty   hwy fl    class
##    <chr>        <chr>    <dbl> <int> <int> <chr>   <chr> <int> <int> <chr> <chr>
##  1 audi         a4         1.8  1999     4 auto(l~ f        18    29 p     comp~
##  2 audi         a4         1.8  1999     4 manual~ f        21    29 p     comp~
##  3 audi         a4         2    2008     4 manual~ f        20    31 p     comp~
##  4 audi         a4         2    2008     4 auto(a~ f        21    30 p     comp~
##  5 audi         a4         2.8  1999     6 auto(l~ f        16    26 p     comp~
##  6 audi         a4         2.8  1999     6 manual~ f        18    26 p     comp~
##  7 audi         a4         3.1  2008     6 auto(a~ f        18    27 p     comp~
##  8 audi         a4 quat~   1.8  1999     4 manual~ 4        18    26 p     comp~
##  9 audi         a4 quat~   1.8  1999     4 auto(l~ 4        16    25 p     comp~
## 10 audi         a4 quat~   2    2008     4 manual~ 4        20    28 p     comp~
## # ... with 224 more rows
```

mpg is a tibble (a data frame with some additionally nice properties) displaying information about 38 car models released between 1999 and 2008. Find more information about this data and the variables here:

```
?mpg
```

Create a subsetted tibble named mpg_eff that contains only vehicles with a highway fuel efficiency of 30 or above.

Hint: Use bracket notation, and remember you just need to filter rows, but you are selecting all of the columns.

Then use an `R` command to report on how many observations are in mpg_eff

```
#solution
mpg_eff=mpg[mpg$hwy>=30,]
nrow(mpg_eff)
```

```
## [1] 26
```

Exercise 11 (Bonus)

(Continued from Exercise 10) Which manufacturer makes the vehicle with the highest **city** fuel efficiency? (Yes, you should use `R` code to find it!)

Hint: For full credit, your answer should be produced from only one line of code, but you can still get half credit if done across several lines of code.

```
#solution
mpg[mpg$cty==max(mpg$cty),]$manufacturer
```

```
## [1] "volkswagen"
```

Exercise 12 (Bonus)

(Continued from Exercises 10 and 11) Let's say that a local law requires city vehicles to have a city mpg rate of at least 20 to be sold within city limits. Create a function that will produce `TRUE` if the inputted value is 20 or above, and `FALSE` if the inputted value is below 20.

Create the function, run it with the mpg data and name the output `pass`, and then column bind this new `pass` variable to the mpg data and call this new data `mpg_pass`.

You are encouraged to print the results for your own sake to check, but please delete the code to avoid printing the full results in your knitted pdf

Finally, run a subset of the mpg_pass data that only includes vehicles that don't pass the standard. No need to save it under a new name first–just print it.

```
#solution
local_law = function(input){
  ifelse(input>=20, TRUE, FALSE)
}
pass = local_law(mpg$cty)
mpg_pass = cbind(mpg, pass)
mpg_pass[mpg_pass$pass == FALSE, ]
```

```
##     manufacturer                  model displ year cyl      trans drv cty hwy
## 1           audi                     a4   1.8 1999   4   auto(l5)   f  18  29
## 5           audi                     a4   2.8 1999   6   auto(l5)   f  16  26
## 6           audi                     a4   2.8 1999   6 manual(m5)   f  18  26
## 7           audi                     a4   3.1 2008   6   auto(av)   f  18  27
## 8           audi             a4 quattro   1.8 1999   4 manual(m5)   4  18  26
## 9           audi             a4 quattro   1.8 1999   4   auto(l5)   4  16  25
## 11          audi             a4 quattro   2.0 2008   4   auto(s6)   4  19  27
## 12          audi             a4 quattro   2.8 1999   6   auto(l5)   4  15  25
## 13          audi             a4 quattro   2.8 1999   6 manual(m5)   4  17  25
## 14          audi             a4 quattro   3.1 2008   6   auto(s6)   4  17  25
## 15          audi             a4 quattro   3.1 2008   6 manual(m6)   4  15  25
## 16          audi             a6 quattro   2.8 1999   6   auto(l5)   4  15  24
## 17          audi             a6 quattro   3.1 2008   6   auto(s6)   4  17  25
## 18          audi             a6 quattro   4.2 2008   8   auto(s6)   4  16  23
## 19     chevrolet     c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  14  20
## 20     chevrolet     c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  11  15
## 21     chevrolet     c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  14  20
## 22     chevrolet     c1500 suburban 2wd   5.7 1999   8   auto(l4)   r  13  17
## 23     chevrolet     c1500 suburban 2wd   6.0 2008   8   auto(l4)   r  12  17
## 24     chevrolet               corvette   5.7 1999   8 manual(m6)   r  16  26
## 25     chevrolet               corvette   5.7 1999   8   auto(l4)   r  15  23
## 26     chevrolet               corvette   6.2 2008   8 manual(m6)   r  16  26
## 27     chevrolet               corvette   6.2 2008   8   auto(s6)   r  15  25
## 28     chevrolet               corvette   7.0 2008   8 manual(m6)   r  15  24
## 29     chevrolet        k1500 tahoe 4wd   5.3 2008   8   auto(l4)   4  14  19
## 30     chevrolet        k1500 tahoe 4wd   5.3 2008   8   auto(l4)   4  11  14
## 31     chevrolet        k1500 tahoe 4wd   5.7 1999   8   auto(l4)   4  11  15
## 32     chevrolet        k1500 tahoe 4wd   6.5 1999   8   auto(l4)   4  14  17
## 33     chevrolet                 malibu   2.4 1999   4   auto(l4)   f  19  27
## 35     chevrolet                 malibu   3.1 1999   6   auto(l4)   f  18  26
## 36     chevrolet                 malibu   3.5 2008   6   auto(l4)   f  18  29
## 37     chevrolet                 malibu   3.6 2008   6   auto(s6)   f  17  26
## 38         dodge            caravan 2wd   2.4 1999   4   auto(l3)   f  18  24
## 39         dodge            caravan 2wd   3.0 1999   6   auto(l4)   f  17  24
## 40         dodge            caravan 2wd   3.3 1999   6   auto(l4)   f  16  22
## 41         dodge            caravan 2wd   3.3 1999   6   auto(l4)   f  16  22
## 42         dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  17  24
## 43         dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  17  24
## 44         dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  11  17
## 45         dodge            caravan 2wd   3.8 1999   6   auto(l4)   f  15  22
## 46         dodge            caravan 2wd   3.8 1999   6   auto(l4)   f  15  21
## 47         dodge            caravan 2wd   3.8 2008   6   auto(l6)   f  16  23
## 48         dodge            caravan 2wd   4.0 2008   6   auto(l6)   f  16  23
## 49         dodge      dakota pickup 4wd   3.7 2008   6 manual(m6)   4  15  19
## 50         dodge      dakota pickup 4wd   3.7 2008   6   auto(l4)   4  14  18
## 51         dodge      dakota pickup 4wd   3.9 1999   6   auto(l4)   4  13  17
## 52         dodge      dakota pickup 4wd   3.9 1999   6 manual(m5)   4  14  17
## 53         dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4  14  19
## 54         dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4  14  19
## 55         dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4   9  12
## 56         dodge      dakota pickup 4wd   5.2 1999   8 manual(m5)   4  11  17
## 57         dodge      dakota pickup 4wd   5.2 1999   8   auto(l4)   4  11  15
## 58         dodge            durango 4wd   3.9 1999   6   auto(l4)   4  13  17
## 59         dodge            durango 4wd   4.7 2008   8   auto(l5)   4  13  17
## 60         dodge            durango 4wd   4.7 2008   8   auto(l5)   4   9  12
## 61         dodge            durango 4wd   4.7 2008   8   auto(l5)   4  13  17
## 62         dodge            durango 4wd   5.2 1999   8   auto(l4)   4  11  16
## 63         dodge            durango 4wd   5.7 2008   8   auto(l5)   4  13  18
## 64         dodge            durango 4wd   5.9 1999   8   auto(l4)   4  11  15
## 65         dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4  12  16
## 66         dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4   9  12
## 67         dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4  13  17
## 68         dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4  13  17
## 69         dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4  12  16
## 70         dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4   9  12
## 71         dodge    ram 1500 pickup 4wd   5.2 1999   8   auto(l4)   4  11  15
## 72         dodge    ram 1500 pickup 4wd   5.2 1999   8 manual(m5)   4  11  16
## 73         dodge    ram 1500 pickup 4wd   5.7 2008   8   auto(l5)   4  13  17
## 74         dodge    ram 1500 pickup 4wd   5.9 1999   8   auto(l4)   4  11  15
## 75          ford         expedition 2wd   4.6 1999   8   auto(l4)   r  11  17
## 76          ford         expedition 2wd   5.4 1999   8   auto(l4)   r  11  17
## 77          ford         expedition 2wd   5.4 2008   8   auto(l6)   r  12  18
## 78          ford           explorer 4wd   4.0 1999   6   auto(l5)   4  14  17
## 79          ford           explorer 4wd   4.0 1999   6 manual(m5)   4  15  19
## 80          ford           explorer 4wd   4.0 1999   6   auto(l5)   4  14  17
## 81          ford           explorer 4wd   4.0 2008   6   auto(l5)   4  13  19
## 82          ford           explorer 4wd   4.6 2008   8   auto(l6)   4  13  19
## 83          ford           explorer 4wd   5.0 1999   8   auto(l4)   4  13  17
## 84          ford        f150 pickup 4wd   4.2 1999   6   auto(l4)   4  14  17
## 85          ford        f150 pickup 4wd   4.2 1999   6 manual(m5)   4  14  17
## 86          ford        f150 pickup 4wd   4.6 1999   8 manual(m5)   4  13  16
## 87          ford        f150 pickup 4wd   4.6 1999   8   auto(l4)   4  13  16
## 88          ford        f150 pickup 4wd   4.6 2008   8   auto(l4)   4  13  17
## 89          ford        f150 pickup 4wd   5.4 1999   8   auto(l4)   4  11  15
## 90          ford        f150 pickup 4wd   5.4 2008   8   auto(l4)   4  13  17
## 91          ford                mustang   3.8 1999   6 manual(m5)   r  18  26
## 92          ford                mustang   3.8 1999   6   auto(l4)   r  18  25
## 93          ford                mustang   4.0 2008   6 manual(m5)   r  17  26
## 94          ford                mustang   4.0 2008   6   auto(l5)   r  16  24
## 95          ford                mustang   4.6 1999   8   auto(l4)   r  15  21
## 96          ford                mustang   4.6 1999   8 manual(m5)   r  15  22
## 97          ford                mustang   4.6 2008   8 manual(m5)   r  15  23
## 98          ford                mustang   4.6 2008   8   auto(l5)   r  15  22
## 99          ford                mustang   5.4 2008   8 manual(m6)   r  14  20
## 109      hyundai                 sonata   2.4 1999   4   auto(l4)   f  18  26
## 110      hyundai                 sonata   2.4 1999   4 manual(m5)   f  18  27
## 113      hyundai                 sonata   2.5 1999   6   auto(l4)   f  18  26
## 114      hyundai                 sonata   2.5 1999   6 manual(m5)   f  18  26
## 115      hyundai                 sonata   3.3 2008   6   auto(l5)   f  19  28
## 116      hyundai                tiburon   2.0 1999   4   auto(l4)   f  19  26
## 117      hyundai                tiburon   2.0 1999   4 manual(m5)   f  19  29
## 120      hyundai                tiburon   2.7 2008   6   auto(l4)   f  17  24
## 121      hyundai                tiburon   2.7 2008   6 manual(m6)   f  16  24
## 122      hyundai                tiburon   2.7 2008   6 manual(m5)   f  17  24
## 123         jeep     grand cherokee 4wd   3.0 2008   6   auto(l5)   4  17  22
## 124         jeep     grand cherokee 4wd   3.7 2008   6   auto(l5)   4  15  19
## 125         jeep     grand cherokee 4wd   4.0 1999   6   auto(l4)   4  15  20
## 126         jeep     grand cherokee 4wd   4.7 1999   8   auto(l4)   4  14  17
## 127         jeep     grand cherokee 4wd   4.7 2008   8   auto(l5)   4   9  12
## 128         jeep     grand cherokee 4wd   4.7 2008   8   auto(l5)   4  14  19
## 129         jeep     grand cherokee 4wd   5.7 2008   8   auto(l5)   4  13  18
## 130         jeep     grand cherokee 4wd   6.1 2008   8   auto(l5)   4  11  14
## 131   land rover            range rover   4.0 1999   8   auto(l4)   4  11  15
## 132   land rover            range rover   4.2 2008   8   auto(s6)   4  12  18
## 133   land rover            range rover   4.4 2008   8   auto(s6)   4  12  18
## 134   land rover            range rover   4.6 1999   8   auto(l4)   4  11  15
## 135      lincoln          navigator 2wd   5.4 1999   8   auto(l4)   r  11  17
## 136      lincoln          navigator 2wd   5.4 1999   8   auto(l4)   r  11  16
## 137      lincoln          navigator 2wd   5.4 2008   8   auto(l6)   r  12  18
## 138      mercury        mountaineer 4wd   4.0 1999   6   auto(l5)   4  14  17
## 139      mercury        mountaineer 4wd   4.0 2008   6   auto(l5)   4  13  19
## 140      mercury        mountaineer 4wd   4.6 2008   8   auto(l6)   4  13  19
## 141      mercury        mountaineer 4wd   5.0 1999   8   auto(l4)   4  13  17
## 143       nissan                 altima   2.4 1999   4   auto(l4)   f  19  27
## 146       nissan                 altima   3.5 2008   6 manual(m6)   f  19  27
## 147       nissan                 altima   3.5 2008   6   auto(av)   f  19  26
## 148       nissan                 maxima   3.0 1999   6   auto(l4)   f  18  26
## 149       nissan                 maxima   3.0 1999   6 manual(m5)   f  19  25
## 150       nissan                 maxima   3.5 2008   6   auto(av)   f  19  25
## 151       nissan         pathfinder 4wd   3.3 1999   6   auto(l4)   4  14  17
## 152       nissan         pathfinder 4wd   3.3 1999   6 manual(m5)   4  15  17
## 153       nissan         pathfinder 4wd   4.0 2008   6   auto(l5)   4  14  20
## 154       nissan         pathfinder 4wd   5.6 2008   8   auto(s5)   4  12  18
## 155      pontiac             grand prix   3.1 1999   6   auto(l4)   f  18  26
## 156      pontiac             grand prix   3.8 1999   6   auto(l4)   f  16  26
## 157      pontiac             grand prix   3.8 1999   6   auto(l4)   f  17  27
## 158      pontiac             grand prix   3.8 2008   6   auto(l4)   f  18  28
## 159      pontiac             grand prix   5.3 2008   8   auto(s4)   f  16  25
## 160       subaru           forester awd   2.5 1999   4 manual(m5)   4  18  25
## 161       subaru           forester awd   2.5 1999   4   auto(l4)   4  18  24
## 163       subaru           forester awd   2.5 2008   4 manual(m5)   4  19  25
## 165       subaru           forester awd   2.5 2008   4   auto(l4)   4  18  23
## 167       subaru            impreza awd   2.2 1999   4 manual(m5)   4  19  26
## 168       subaru            impreza awd   2.5 1999   4 manual(m5)   4  19  26
## 169       subaru            impreza awd   2.5 1999   4   auto(l4)   4  19  26
## 172       subaru            impreza awd   2.5 2008   4 manual(m5)   4  19  25
## 174       toyota            4runner 4wd   2.7 1999   4 manual(m5)   4  15  20
## 175       toyota            4runner 4wd   2.7 1999   4   auto(l4)   4  16  20
## 176       toyota            4runner 4wd   3.4 1999   6   auto(l4)   4  15  19
## 177       toyota            4runner 4wd   3.4 1999   6 manual(m5)   4  15  17
## 178       toyota            4runner 4wd   4.0 2008   6   auto(l5)   4  16  20
## 179       toyota            4runner 4wd   4.7 2008   8   auto(l5)   4  14  17
## 184       toyota                  camry   3.0 1999   6   auto(l4)   f  18  26
## 185       toyota                  camry   3.0 1999   6 manual(m5)   f  18  26
## 186       toyota                  camry   3.5 2008   6   auto(s6)   f  19  28
## 191       toyota           camry solara   3.0 1999   6   auto(l4)   f  18  26
## 192       toyota           camry solara   3.0 1999   6 manual(m5)   f  18  26
## 193       toyota           camry solara   3.3 2008   6   auto(s5)   f  18  27
## 199       toyota land cruiser wagon 4wd   4.7 1999   8   auto(l4)   4  11  15
## 200       toyota land cruiser wagon 4wd   5.7 2008   8   auto(s6)   4  13  18
## 201       toyota      toyota tacoma 4wd   2.7 1999   4 manual(m5)   4  15  20
## 202       toyota      toyota tacoma 4wd   2.7 1999   4   auto(l4)   4  16  20
## 203       toyota      toyota tacoma 4wd   2.7 2008   4 manual(m5)   4  17  22
## 204       toyota      toyota tacoma 4wd   3.4 1999   6 manual(m5)   4  15  17
## 205       toyota      toyota tacoma 4wd   3.4 1999   6   auto(l4)   4  15  19
## 206       toyota      toyota tacoma 4wd   4.0 2008   6 manual(m6)   4  15  18
## 207       toyota      toyota tacoma 4wd   4.0 2008   6   auto(l5)   4  16  20
## 209   volkswagen                    gti   2.0 1999   4   auto(l4)   f  19  26
## 212   volkswagen                    gti   2.8 1999   6 manual(m5)   f  17  24
## 215   volkswagen                  jetta   2.0 1999   4   auto(l4)   f  19  26
## 220   volkswagen                  jetta   2.8 1999   6   auto(l4)   f  16  23
## 221   volkswagen                  jetta   2.8 1999   6 manual(m5)   f  17  24
## 225   volkswagen             new beetle   2.0 1999   4   auto(l4)   f  19  26
## 229   volkswagen                 passat   1.8 1999   4   auto(l5)   f  18  29
## 230   volkswagen                 passat   2.0 2008   4   auto(s6)   f  19  28
## 232   volkswagen                 passat   2.8 1999   6   auto(l5)   f  16  26
## 233   volkswagen                 passat   2.8 1999   6 manual(m5)   f  18  26
## 234   volkswagen                 passat   3.6 2008   6   auto(s6)   f  17  26
##     fl      class  pass
## 1    p    compact FALSE
## 5    p    compact FALSE
## 6    p    compact FALSE
## 7    p    compact FALSE
## 8    p    compact FALSE
## 9    p    compact FALSE
## 11   p    compact FALSE
## 12   p    compact FALSE
## 13   p    compact FALSE
## 14   p    compact FALSE
## 15   p    compact FALSE
## 16   p    midsize FALSE
## 17   p    midsize FALSE
## 18   p    midsize FALSE
## 19   r        suv FALSE
## 20   e        suv FALSE
## 21   r        suv FALSE
## 22   r        suv FALSE
## 23   r        suv FALSE
## 24   p    2seater FALSE
## 25   p    2seater FALSE
## 26   p    2seater FALSE
## 27   p    2seater FALSE
## 28   p    2seater FALSE
## 29   r        suv FALSE
## 30   e        suv FALSE
## 31   r        suv FALSE
## 32   d        suv FALSE
## 33   r    midsize FALSE
## 35   r    midsize FALSE
## 36   r    midsize FALSE
## 37   r    midsize FALSE
## 38   r    minivan FALSE
## 39   r    minivan FALSE
## 40   r    minivan FALSE
## 41   r    minivan FALSE
## 42   r    minivan FALSE
## 43   r    minivan FALSE
## 44   e    minivan FALSE
## 45   r    minivan FALSE
## 46   r    minivan FALSE
## 47   r    minivan FALSE
## 48   r    minivan FALSE
## 49   r     pickup FALSE
## 50   r     pickup FALSE
## 51   r     pickup FALSE
## 52   r     pickup FALSE
## 53   r     pickup FALSE
## 54   r     pickup FALSE
## 55   e     pickup FALSE
## 56   r     pickup FALSE
## 57   r     pickup FALSE
## 58   r        suv FALSE
## 59   r        suv FALSE
## 60   e        suv FALSE
## 61   r        suv FALSE
## 62   r        suv FALSE
## 63   r        suv FALSE
## 64   r        suv FALSE
## 65   r     pickup FALSE
## 66   e     pickup FALSE
## 67   r     pickup FALSE
## 68   r     pickup FALSE
## 69   r     pickup FALSE
## 70   e     pickup FALSE
## 71   r     pickup FALSE
## 72   r     pickup FALSE
## 73   r     pickup FALSE
## 74   r     pickup FALSE
## 75   r        suv FALSE
## 76   r        suv FALSE
## 77   r        suv FALSE
## 78   r        suv FALSE
## 79   r        suv FALSE
## 80   r        suv FALSE
## 81   r        suv FALSE
## 82   r        suv FALSE
## 83   r        suv FALSE
## 84   r     pickup FALSE
## 85   r     pickup FALSE
## 86   r     pickup FALSE
## 87   r     pickup FALSE
## 88   r     pickup FALSE
## 89   r     pickup FALSE
## 90   r     pickup FALSE
## 91   r subcompact FALSE
## 92   r subcompact FALSE
## 93   r subcompact FALSE
## 94   r subcompact FALSE
## 95   r subcompact FALSE
## 96   r subcompact FALSE
## 97   r subcompact FALSE
## 98   r subcompact FALSE
## 99   p subcompact FALSE
## 109  r    midsize FALSE
## 110  r    midsize FALSE
## 113  r    midsize FALSE
## 114  r    midsize FALSE
## 115  r    midsize FALSE
## 116  r subcompact FALSE
## 117  r subcompact FALSE
## 120  r subcompact FALSE
## 121  r subcompact FALSE
## 122  r subcompact FALSE
## 123  d        suv FALSE
## 124  r        suv FALSE
## 125  r        suv FALSE
## 126  r        suv FALSE
## 127  e        suv FALSE
## 128  r        suv FALSE
## 129  r        suv FALSE
## 130  p        suv FALSE
## 131  p        suv FALSE
## 132  r        suv FALSE
## 133  r        suv FALSE
## 134  p        suv FALSE
## 135  r        suv FALSE
## 136  p        suv FALSE
## 137  r        suv FALSE
## 138  r        suv FALSE
## 139  r        suv FALSE
## 140  r        suv FALSE
## 141  r        suv FALSE
## 143  r    compact FALSE
## 146  p    midsize FALSE
## 147  p    midsize FALSE
## 148  r    midsize FALSE
## 149  r    midsize FALSE
## 150  p    midsize FALSE
## 151  r        suv FALSE
## 152  r        suv FALSE
## 153  p        suv FALSE
## 154  p        suv FALSE
## 155  r    midsize FALSE
## 156  p    midsize FALSE
## 157  r    midsize FALSE
## 158  r    midsize FALSE
## 159  p    midsize FALSE
## 160  r        suv FALSE
## 161  r        suv FALSE
## 163  p        suv FALSE
## 165  p        suv FALSE
## 167  r subcompact FALSE
## 168  r subcompact FALSE
## 169  r subcompact FALSE
## 172  p    compact FALSE
## 174  r        suv FALSE
## 175  r        suv FALSE
## 176  r        suv FALSE
## 177  r        suv FALSE
## 178  r        suv FALSE
## 179  r        suv FALSE
## 184  r    midsize FALSE
## 185  r    midsize FALSE
## 186  r    midsize FALSE
## 191  r    compact FALSE
## 192  r    compact FALSE
## 193  r    compact FALSE
## 199  r        suv FALSE
## 200  r        suv FALSE
## 201  r     pickup FALSE
## 202  r     pickup FALSE
## 203  r     pickup FALSE
## 204  r     pickup FALSE
## 205  r     pickup FALSE
## 206  r     pickup FALSE
## 207  r     pickup FALSE
## 209  r    compact FALSE
## 212  r    compact FALSE
## 215  r    compact FALSE
## 220  r    compact FALSE
## 221  r    compact FALSE
## 225  r subcompact FALSE
## 229  p    midsize FALSE
## 230  p    midsize FALSE
## 232  p    midsize FALSE
## 233  p    midsize FALSE
## 234  p    midsize FALSE
```