Math 189 HW 1

Code

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Math 189 Section B

Code

model <chr>	mpg <dbl>	cyl <int>	disp <dbl>	hp <int>	drat <dbl>	wt <dbl>	qsec <dbl>	vs <int>	am <int>
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0

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1. Calculate Sample mean and Variance

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```
cars <- subset(cars, select= -c(model))
#View(cars)
colMeans(cars)
```

```
       mpg        cyl       disp         hp       drat         wt       qsec         vs
am
 20.090625   6.187500 230.721875 146.687500   3.596563   3.217250  17.848750   0.437500
0.406250
      gear       carb
  3.687500   2.812500
```

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```
sapply(cars, var)
```

```
        mpg          cyl         disp           hp         drat           wt         qs
ec           vs
3.632410e+01 3.189516e+00 1.536080e+04 4.700867e+03 2.858814e-01 9.573790e-01 3.193166e+
00 2.540323e-01
          am         gear         carb
2.489919e-01 5.443548e-01 2.608871e+00
```

2. The diagonaol of the variance matrix is the variances of each variable. The diagonals of the corrleation matrix is 1. They are also both symmetric.

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```
cov(cars)
```

```
            mpg         cyl        disp          hp         drat          wt         qs
ec           vs
mpg    36.324103  -9.1723790  -633.09721 -320.732056   2.19506351  -5.1166847   4.509149
19   2.01713710
cyl    -9.172379   3.1895161   199.66028  101.931452  -0.66836694   1.3673710  -1.886854
84  -0.72983871
disp -633.097208 199.6602823 15360.79983 6721.158669 -47.06401915 107.6842040 -96.051681
45 -44.37762097
hp   -320.732056 101.9314516  6721.15867 4700.866935 -16.45110887  44.1926613 -86.770080
65 -24.98790323
drat    2.195064  -0.6683669   -47.06402  -16.451109   0.28588135  -0.3727207   0.087140
73   0.11864919
wt     -5.116685   1.3673710   107.68420   44.192661  -0.37272073   0.9573790  -0.305481
61  -0.27366129
qsec    4.509149  -1.8868548   -96.05168  -86.770081   0.08714073  -0.3054816   3.193166
13   0.67056452
vs      2.017137  -0.7298387   -44.37762  -24.987903   0.11864919  -0.2736613   0.670564
52   0.25403226
am      1.803931  -0.4657258   -36.56401   -8.320565   0.19015121  -0.3381048  -0.204959
68   0.04233871
gear    2.135685  -0.6491935   -50.80262   -6.358871   0.27598790  -0.4210806  -0.280403
23   0.07661290
carb   -5.363105   1.5201613    79.06875   83.036290  -0.07840726   0.6757903  -1.894112
90  -0.46370968
               am        gear        carb
mpg    1.80393145   2.1356855 -5.36310484
cyl   -0.46572581  -0.6491935  1.52016129
disp -36.56401210 -50.8026210 79.06875000
hp    -8.32056452  -6.3588710 83.03629032
drat   0.19015121   0.2759879 -0.07840726
wt    -0.33810484  -0.4210806  0.67579032
qsec  -0.20495968  -0.2804032 -1.89411290
vs     0.04233871   0.0766129 -0.46370968
am     0.24899194   0.2923387  0.04637097
gear   0.29233871   0.5443548  0.32661290
carb   0.04637097   0.3266129  2.60887097
```

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```
cor(cars)
```

```
            mpg        cyl       disp         hp        drat         wt        qsec
vs          am
mpg   1.0000000 -0.8521620 -0.8475514 -0.7761684  0.68117191 -0.8676594  0.41868403  0.6
640389  0.59983243
cyl  -0.8521620  1.0000000  0.9020329  0.8324475 -0.69993811  0.7824958 -0.59124207 -0.8
108118 -0.52260705
disp -0.8475514  0.9020329  1.0000000  0.7909486 -0.71021393  0.8879799 -0.43369788 -0.7
104159 -0.59122704
hp   -0.7761684  0.8324475  0.7909486  1.0000000 -0.44875912  0.6587479 -0.70822339 -0.7
230967 -0.24320426
drat  0.6811719 -0.6999381 -0.7102139 -0.4487591  1.00000000 -0.7124406  0.09120476  0.4
402785  0.71271113
wt   -0.8676594  0.7824958  0.8879799  0.6587479 -0.71244065  1.0000000 -0.17471588 -0.5
549157 -0.69249526
qsec  0.4186840 -0.5912421 -0.4336979 -0.7082234  0.09120476 -0.1747159  1.00000000  0.7
445354 -0.22986086
vs    0.6640389 -0.8108118 -0.7104159 -0.7230967  0.44027846 -0.5549157  0.74453544  1.0
000000  0.16834512
am    0.5998324 -0.5226070 -0.5912270 -0.2432043  0.71271113 -0.6924953 -0.22986086  0.1
683451  1.00000000
gear  0.4802848 -0.4926866 -0.5555692 -0.1257043  0.69961013 -0.5832870 -0.21268223  0.2
060233  0.79405876
carb -0.5509251  0.5269883  0.3949769  0.7498125 -0.09078980  0.4276059 -0.65624923 -0.5
696071  0.05753435
           gear        carb
mpg   0.4802848 -0.55092507
cyl  -0.4926866  0.52698829
disp -0.5555692  0.39497686
hp   -0.1257043  0.74981247
drat  0.6996101 -0.09078980
wt   -0.5832870  0.42760594
qsec -0.2126822 -0.65624923
vs    0.2060233 -0.56960714
am    0.7940588  0.05753435
gear  1.0000000  0.27407284
carb  0.2740728  1.00000000
```

3. Scatterplot between Wt and Mpg

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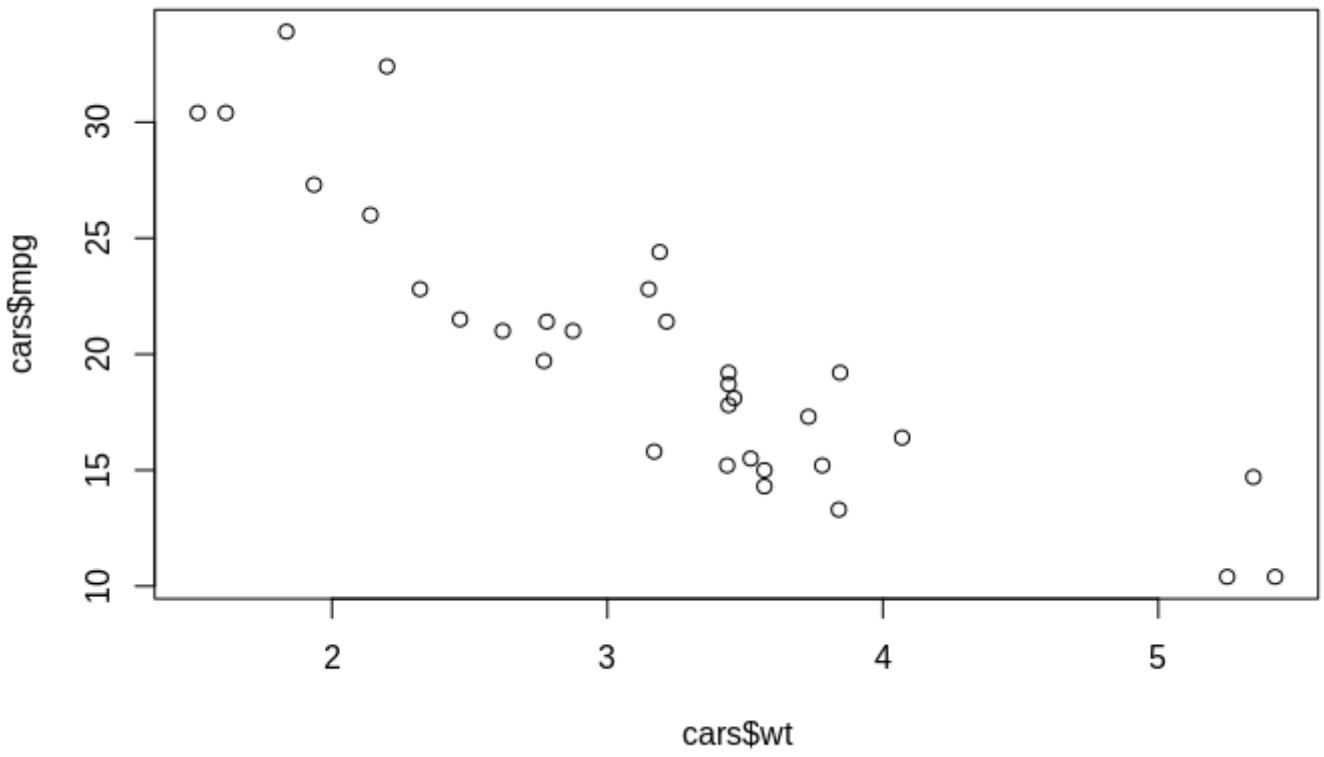
```
plot(cars$wt, cars$mpg)
```



4. Drawing 3D scatterplot using columns of mtcars

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```
#install.packages("tidyverse")
library(tidyverse)
```

```
Registered S3 methods overwritten by 'dbplyr':
  method         from
  print.tbl_lazy
  print.tbl_sql
```

```
── Attaching packages ─────────────────────────────────────────────────────────
─ tidyverse 1.3.2 ──
✔ ggplot2 3.3.5     ✔ purrr   0.3.4
✔ tibble  3.1.8     ✔ dplyr   1.0.7
✔ tidyr   1.2.1     ✔ stringr 1.4.0
✔ readr   2.1.3     ✔ forcats 0.5.1
── Conflicts ────────────────────────────────────────────────────────── tidy
verse_conflicts() ──
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
```

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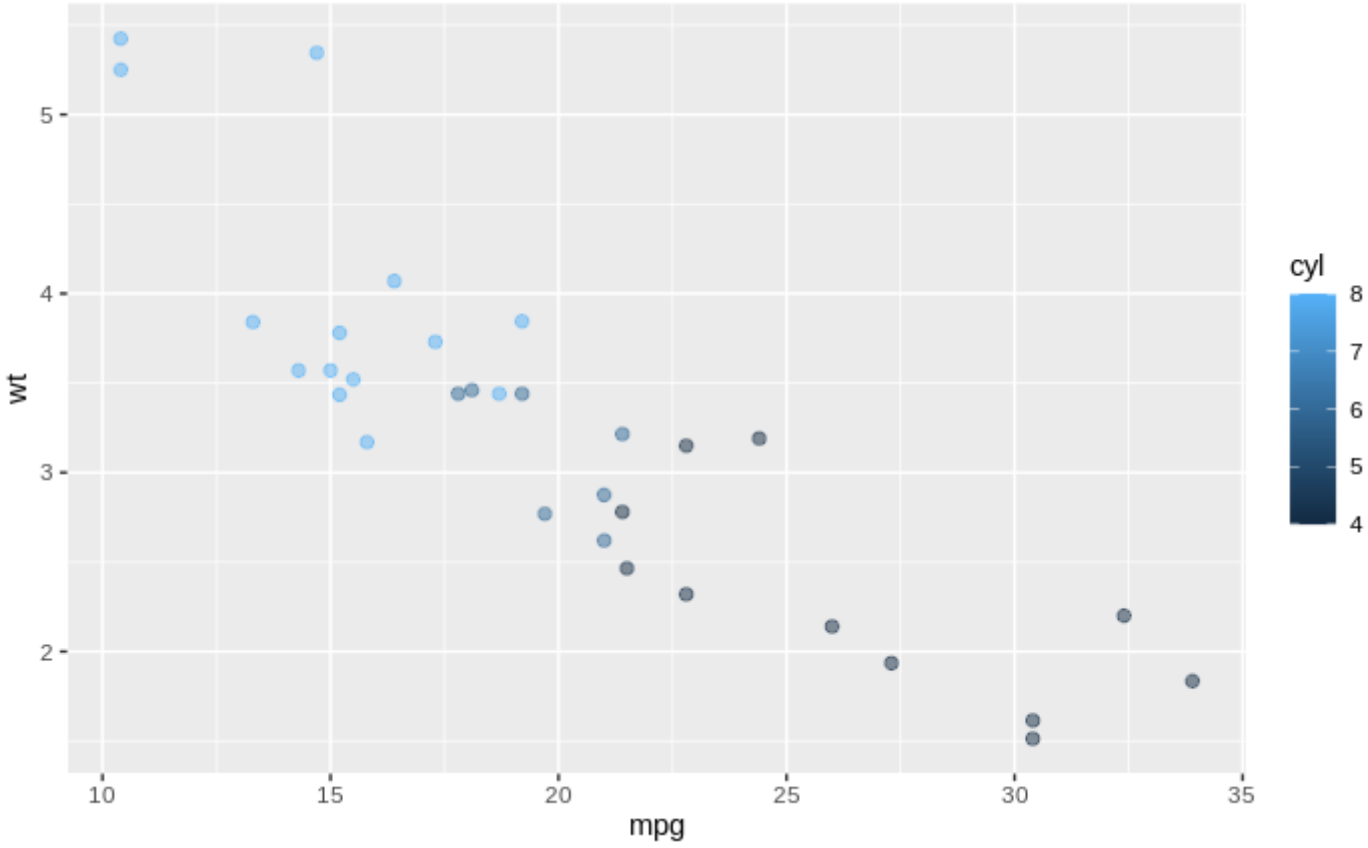
```
#scatterplot3d(x = cars$mpg, y=cars$wt, z=cars$cyl)
#plot_ly(x=cars$mpg, y=cars$wt, z=cars$cyl, type="scatter3d", mode="markers", color=cars
$cyl)
#lot3d(cars$wt, cars$disp, cars$mpg, type = "s", size = 0.75, lit = FALSE)
cars |>
  ggplot(aes(mpg, wt)) + geom_point(alpha=0.5, size=2, aes(color=cyl))
```



5. Pairwise scatterplot

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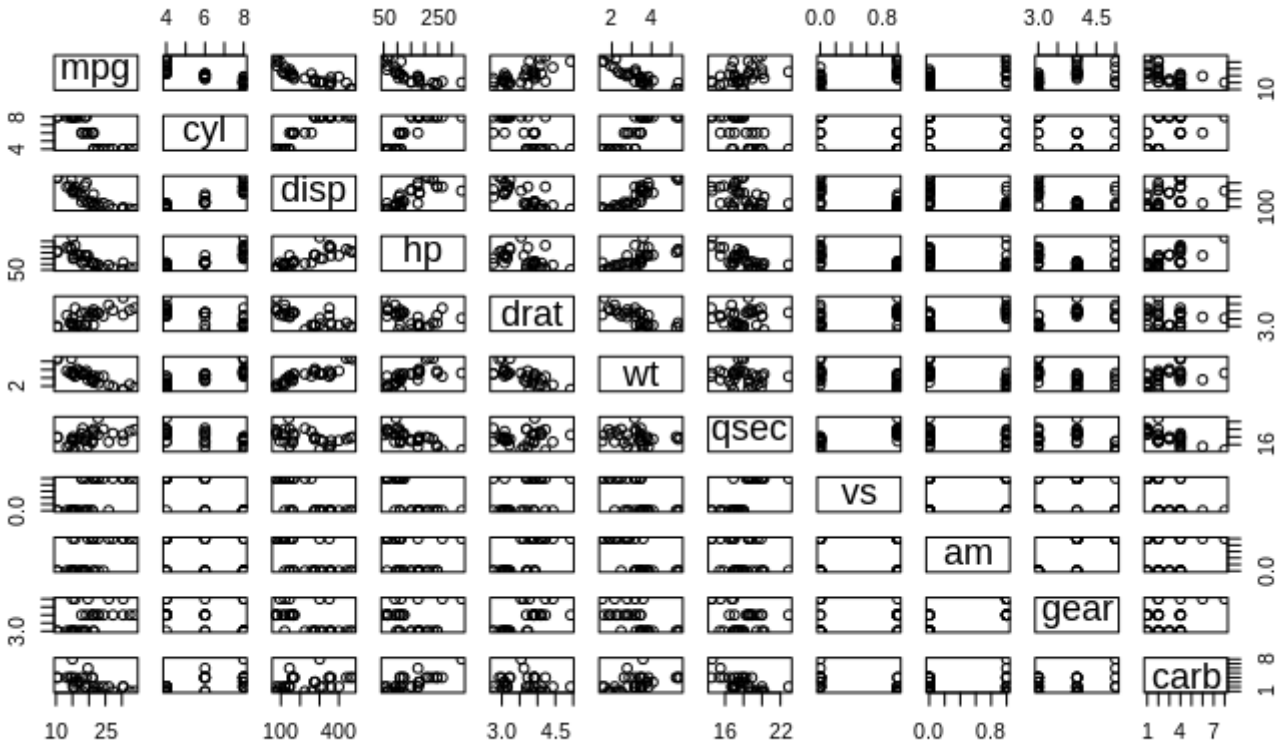
```
pairs(cars)
```



6. Yes it looks like cylinders has an impact on the relationship between weight and MPG. The lighter the shade of blue of an observation , the more cylinders it has. From the scatterplot in 4, we can clearly see that there is a linear relationship between the shades of blue and points with similar weight and MPG. Cars with lower weight and mpg have lighter shades of blue than those with heavier weights and higher mpg.