Week 8 – Data Exploration and Summary

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Welcome!

Welcome to *week 8*!

Record the meeting

Breakout rooms!

Starting with whomever has the most bandwidth at home/outside of school (and work):

One question:

- What is something you're grateful for?

One reflection/discussion:

- What is one thing that you like about this course? And, what is one thing about this course that you wished were different?

Review of last week's class

- Using color
- Grouping and stacking bar charts
- Faceting charts

Sometimes, a table says it better

From webinar: https://jrosen48.github.io/airs-ngss-survey/

Recording: https://www.youtube.com/watch?v=WxdWzTIzYml

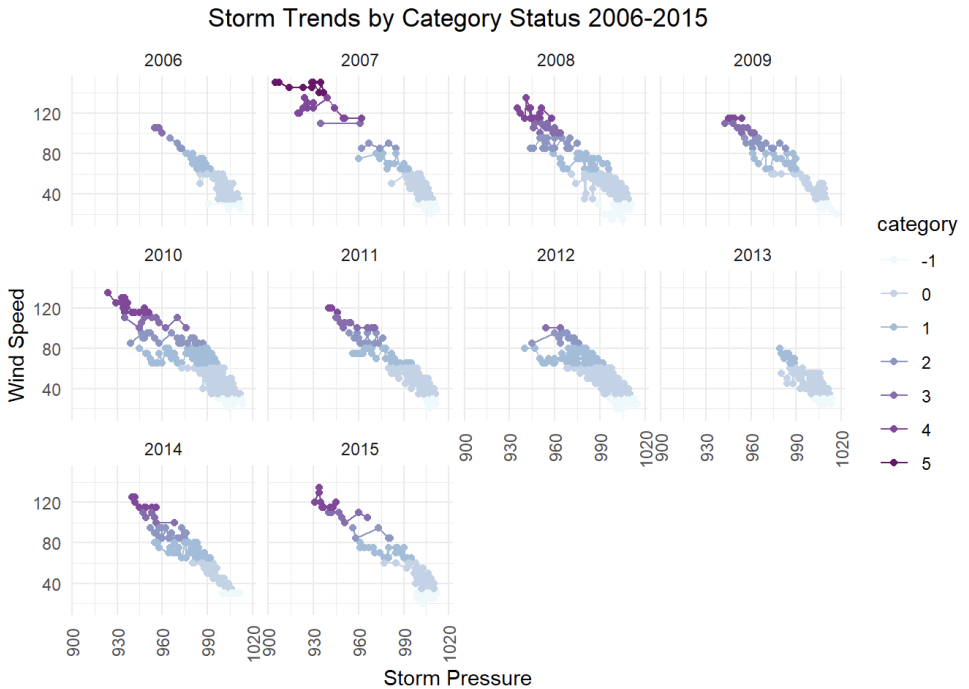
Table 1

Percentage of Teachers Reporting Their School is Teaching the NGSS by State by NGSS Adoption Status

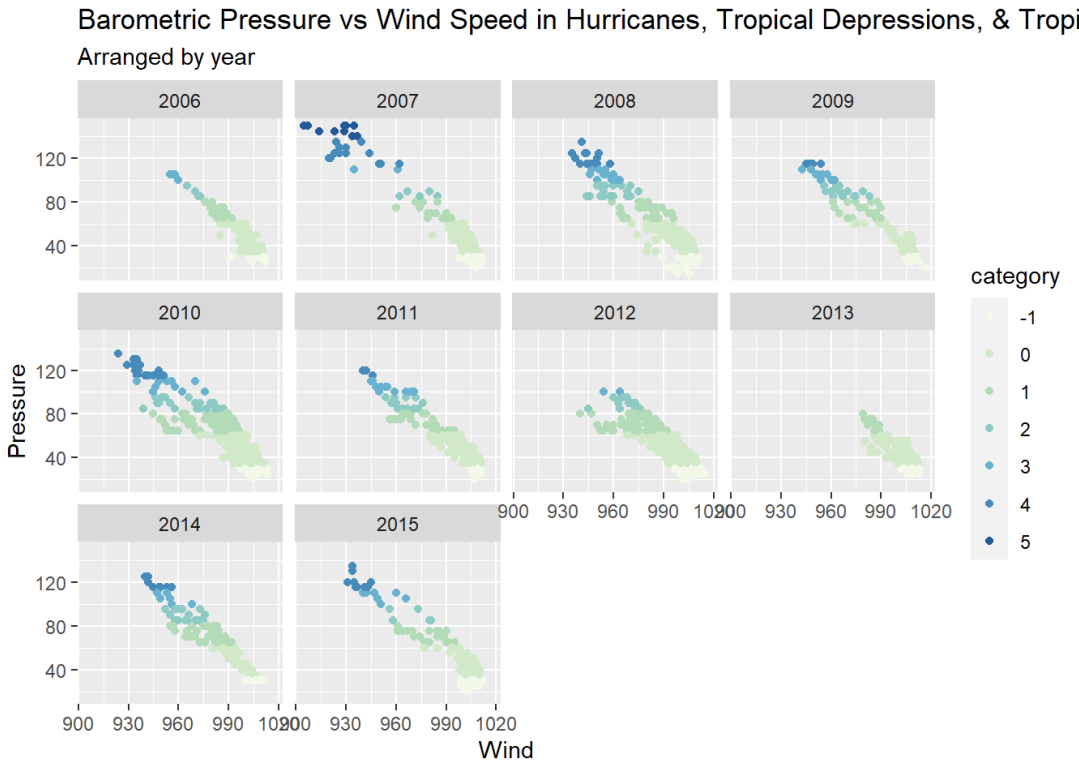
Adoption Status	# of States in AIRS Sample	Mean % (2019)	Mean % (2020)	Mean % (Both Years)
The NGSS	5	78%	86%	82%
Standards Based on the NGSS	6	49%	57%	53%
Neither Based on the NGSS nor the NGSS	1	64%	61%	63%
Total (Mean %)	12	61%	67%	64%

Homework highlights

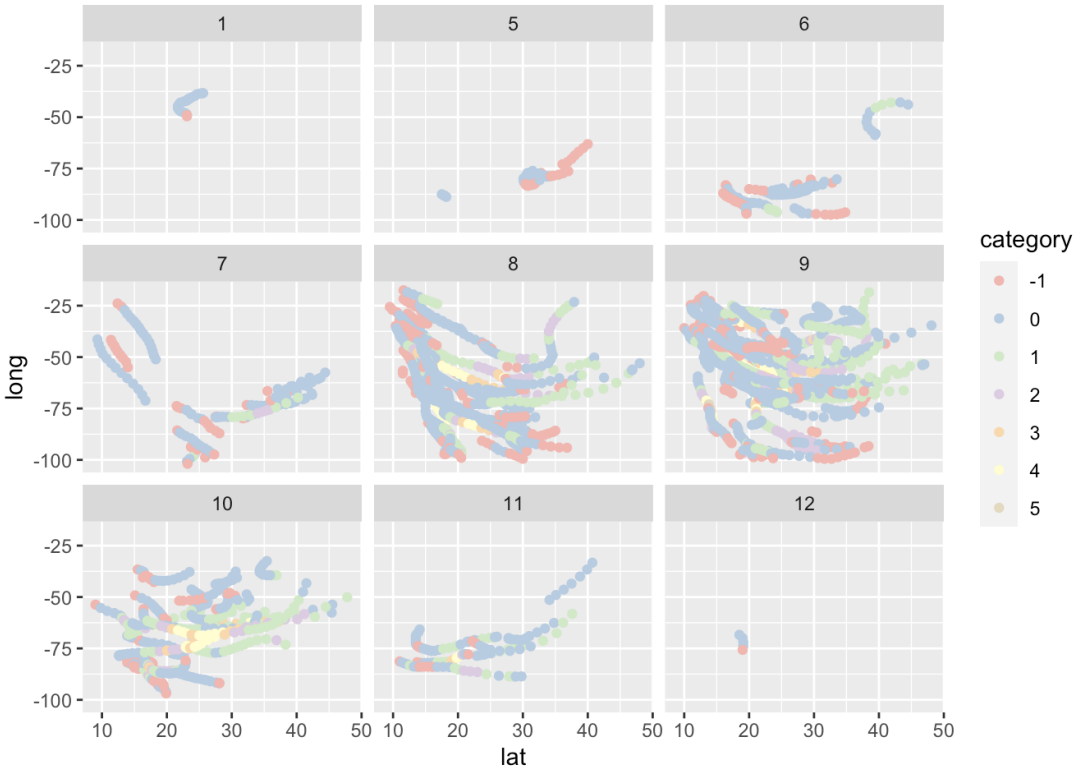
```
FilteredStorms %>%
  ggplot(aes(x= pressure, y= wind, color= category)) +
  geom_point()+
  geom_line()+
  theme_minimal()+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust = 0.7))+
  scale_color_brewer(type = "seq", palette = "BuPu")+
  facet_wrap(~year)+
  xlab("Storm Pressure")+
  ylab("Wind Speed")+
  ggtitle("Storm Trends by Category Status 2006-2015")+
  ggeasy::easy_center_title()
```



```
storms_2006 %>%
  ggplot(aes(pressure, wind, color = category)) +
  geom_point() +
  scale_color_brewer(type = "seq", palette = "GnBu") +
  facet_wrap(~year)+
  xlab("Wind") +
  ylab("Pressure") +
  ggtitle("Barometric Pressure vs Wind Speed in Hurricanes, Tropical Depressions, & Tropical Storms by Category")
+
  labs(subtitle = "Arranged by year")
```



```
ggplot(St,aes(x=lat,y=long,color=category))+
  geom_point()+
  scale_color_brewer(type="qual",palette = 4)+
  facet_wrap(~month)
```



This week's topics

Overview

A. Summarizing variables

B. Inspecting data frames and correlations

C. Summary tables

A. Summarizing variables

Overview

- Sometimes you need to summarize variables
- Data viz is often a good tool to use
- Statistics are important too

As always with R, there are multiple ways to get there.

A. Summarizing variables – Base R

`library(🤷)`

```
summary(mtcars)
```

```
##       mpg             cyl             disp             hp       
##  Min.   :10.40   Min.   :4.000   Min.   : 71.1   Min.   : 52.0  
##  1st Qu.:15.43   1st Qu.:4.000   1st Qu.:120.8   1st Qu.: 96.5  
##  Median :19.20   Median :6.000   Median :196.3   Median :123.0  
##  Mean   :20.09   Mean   :6.188   Mean   :230.7   Mean   :146.7  
##  3rd Qu.:22.80   3rd Qu.:8.000   3rd Qu.:326.0   3rd Qu.:180.0  
##  Max.   :33.90   Max.   :8.000   Max.   :472.0   Max.   :335.0  
##       drat             wt             qsec             vs        
##  Min.   :2.760   Min.   :1.513   Min.   :14.50   Min.   :0.0000  
##  1st Qu.:3.080   1st Qu.:2.581   1st Qu.:16.89   1st Qu.:0.0000  
##  Median :3.695   Median :3.325   Median :17.71   Median :0.0000  
##  Mean   :3.597   Mean   :3.217   Mean   :17.85   Mean   :0.4375  
##  3rd Qu.:3.920   3rd Qu.:3.610   3rd Qu.:18.90   3rd Qu.:1.0000  
##  Max.   :4.930   Max.   :5.424   Max.   :22.90   Max.   :1.0000  
##        am              gear            carb      
##  Min.   :0.0000   Min.   :3.000   Min.   :1.000  
##  1st Qu.:0.0000   1st Qu.:3.000   1st Qu.:2.000  
##  Median :0.0000   Median :4.000   Median :2.000  
##  Mean   :0.4062   Mean   :3.688   Mean   :2.812  
##  3rd Qu.:1.0000   3rd Qu.:4.000   3rd Qu.:4.000  
##  Max.   :1.0000   Max.   :5.000   Max.   :8.000
```

A. Summarizing variables – skimr

skimr package – https://cran.r-project.org/web/packages/skimr/vignettes/skimr.html

```
library(skimr)

skim(mtcars)
```

Table: Data summary

Name	mtcars
Number of rows	32
Number of columns	11
–	
Column type frequency:	
numeric	11
—	
Group variables	None

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
mpg	0	1	20.09	6.03	10.40	15.43	19.20	22.80	33.90	▆▇▃▂▁
cyl	0	1	6.19	1.79	4.00	4.00	6.00	8.00	8.00	▆▁▃▁▇
disp	0	1	230.72	123.94	71.10	120.83	196.30	326.00	472.00	▇▃▂▂▂
hp	0	1	146.69	68.56	52.00	96.50	123.00	180.00	335.00	▇▇▆▃▁
drat	0	1	3.60	0.53	2.76	3.08	3.70	3.92	4.93	▅▁▆▅▂
wt	0	1	3.22	0.98	1.51	2.58	3.33	3.61	5.42	▂▃▇▁▂
qsec	0	1	17.85	1.79	14.50	16.89	17.71	18.90	22.90	▃▇▇▂▁
vs	0	1	0.44	0.50	0.00	0.00	0.00	1.00	1.00	▇▁▁▁▆
am	0	1	0.41	0.50	0.00	0.00	0.00	1.00	1.00	▇▁▁▁▆
gear	0	1	3.69	0.74	3.00	3.00	4.00	4.00	5.00	▇▁▆▁▂
carb	0	1	2.81	1.62	1.00	2.00	2.00	4.00	8.00	▇▆▁▂▁

A. Summarizing variables – skimr

Grouping also works with some of these summary functions

```
mtcars %>%
  group_by(am) %>%
  skim()
```

Table: Data summary

Name	Piped data
Number of rows	32
Number of columns	11
-	
Column type frequency:	
numeric	10
—	
Group variables	am

Variable type: numeric

skim_variable	am	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
mpg	0	0	1	17.15	3.83	10.40	14.95	17.30	19.20	24.40	
mpg	1	0	1	24.39	6.17	15.00	21.00	22.80	30.40	33.90	
cyl	0	0	1	6.95	1.54	4.00	6.00	8.00	8.00	8.00	
cyl	1	0	1	5.08	1.55	4.00	4.00	4.00	6.00	8.00	
disp	0	0	1	290.38	110.17	120.10	196.30	275.80	360.00	472.00	
disp	1	0	1	143.53	87.20	71.10	79.00	120.30	160.00	351.00	
hp	0	0	1	160.26	53.91	62.00	116.50	175.00	192.50	245.00	
hp	1	0	1	126.85	84.06	52.00	66.00	109.00	113.00	335.00	
drat	0	0	1	3.29	0.39	2.76	3.07	3.15	3.70	3.92	
drat	1	0	1	4.05	0.36	3.54	3.85	4.08	4.22	4.93	
wt	0	0	1	3.77	0.78	2.46	3.44	3.52	3.84	5.42	

A. Summarizing variables – psych

```
library(psych)

describe(mtcars)
```

```
##       vars  n   mean     sd median trimmed    mad   min    max  range  skew
## mpg      1 32  20.09   6.03  19.20   19.70   5.41 10.40  33.90  23.50  0.61
## cyl      2 32   6.19   1.79   6.00    6.23   2.97  4.00   8.00   4.00 -0.17
## disp     3 32 230.72 123.94 196.30  222.52 140.48 71.10 472.00 400.90  0.38
## hp       4 32 146.69  68.56 123.00  141.19  77.10 52.00 335.00 283.00  0.73
## drat     5 32   3.60   0.53   3.70    3.58   0.70  2.76   4.93   2.17  0.27
## wt       6 32   3.22   0.98   3.33    3.15   0.77  1.51   5.42   3.91  0.42
## qsec     7 32  17.85   1.79  17.71   17.83   1.42 14.50  22.90   8.40  0.37
## vs       8 32   0.44   0.50   0.00    0.42   0.00  0.00   1.00   1.00  0.24
## am       9 32   0.41   0.50   0.00    0.38   0.00  0.00   1.00   1.00  0.36
## gear    10 32   3.69   0.74   4.00    3.62   1.48  3.00   5.00   2.00  0.53
## carb    11 32   2.81   1.62   2.00    2.65   1.48  1.00   8.00   7.00  1.05
##       kurtosis    se
## mpg      -0.37  1.07
## cyl      -1.76  0.32
## disp     -1.21 21.91
## hp       -0.14 12.12
## drat     -0.71  0.09
## wt       -0.02  0.17
## qsec      0.34  0.32
## vs       -2.00  0.09
## am       -1.92  0.09
## gear     -1.07  0.13
## carb      1.26  0.29
```

A. Summarizing variables

Can also use subsets of variables

```
mtcars %>% select(mpg, cyl, disp) %>%
  describe()
```

```
##      vars  n   mean     sd median trimmed    mad  min   max range  skew
## mpg     1 32  20.09   6.03   19.2   19.70   5.41 10.4  33.9  23.5  0.61
## cyl     2 32   6.19   1.79    6.0    6.23   2.97  4.0   8.0   4.0 -0.17
## disp    3 32 230.72 123.94  196.3  222.52 140.48 71.1 472.0 400.9  0.38
##      kurtosis    se
## mpg     -0.37  1.07
## cyl     -1.76  0.32
## disp    -1.21 21.91
```

A. Summarizing variables

Or subsets of rows

```
mtcars %>% filter(str_detect(row.names(mtcars), "Merc")) %>%
  describe()
```

```
##      vars n   mean    sd median trimmed   mad    min    max  range  skew
## mpg     1 7  19.01  3.40  17.80   19.01  2.08  15.20  24.40   9.20  0.48
## cyl     2 7   6.29  1.80   6.00    6.29  2.97   4.00   8.00   4.00 -0.22
## disp    3 7 207.16 64.97 167.60  207.16 39.73 140.80 275.80 135.00  0.17
## hp      4 7 134.71 47.07 123.00  134.71 84.51  62.00 180.00 118.00 -0.24
## drat    5 7   3.52  0.43   3.69    3.52  0.34   3.07   3.92   0.85 -0.15
## wt      6 7   3.54  0.33   3.44    3.54  0.43   3.15   4.07   0.92  0.23
## qsec    7 7  19.01  1.92  18.30   19.01  1.04  17.40  22.90   5.50  1.03
## vs      8 7   0.57  0.53   1.00    0.57  0.00   0.00   1.00   1.00 -0.23
## am      9 7   0.00  0.00   0.00    0.00  0.00   0.00   0.00   0.00   NaN
## gear   10 7   3.57  0.53   4.00    3.57  0.00   3.00   4.00   1.00 -0.23
## carb   11 7   3.00  0.82   3.00    3.00  1.48   2.00   4.00   2.00  0.00
##      kurtosis    se
## mpg     -1.59  1.28
## cyl     -1.90  0.68
## disp    -2.16 24.55
## hp      -1.75 17.79
## drat    -2.17  0.16
## wt      -1.61  0.13
## qsec    -0.49  0.73
## vs      -2.20  0.20
## am        NaN  0.00
## gear    -2.20  0.20
## carb    -1.71  0.31
```

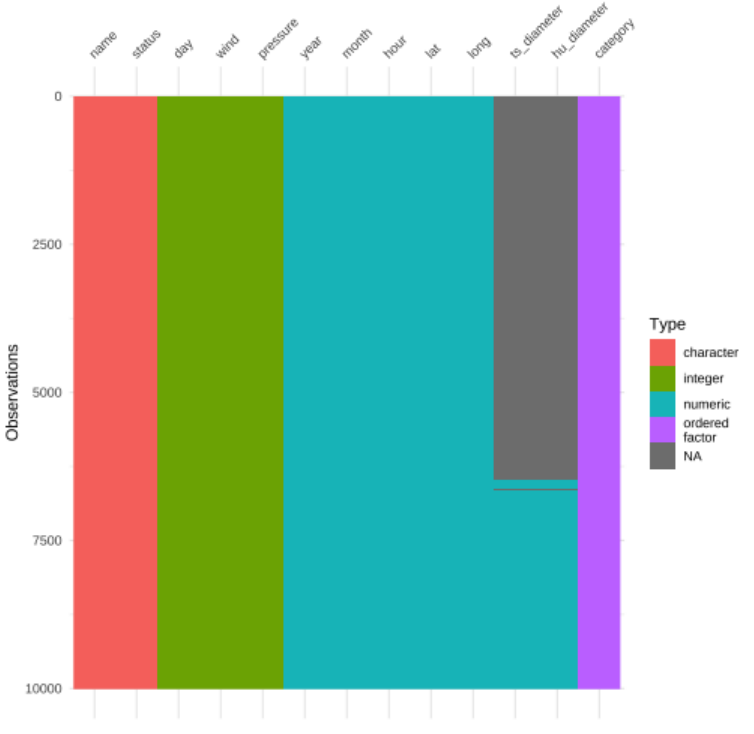
B. Inspecting data frames and correlations

Another handy package is visdat: https://cran.r-project.org/web/packages/visdat/vignettes/using_visdat.html

Lets you essentially visualize the sort of information you see in `glimpse()`

```
library(visdat)

vis_dat(storms)
```



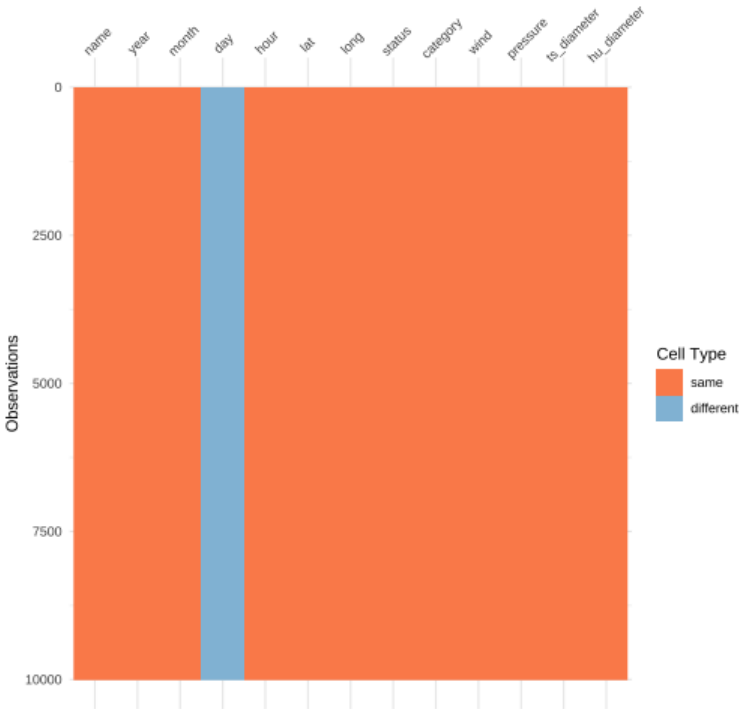
B. Inspecting data frames and correlations

Another useful function from visdat is `vis_compare()`

This lets you compare two data sets of the same size to see what's different

```
storms_2 <- storms %>% mutate(day = as.numeric(day))

vis_compare(storms, storms_2)
```



B. Inspecting data frames and correlations

Correlations are something you'll probably want to look at.

Base R:

```
cor(mtcars)
```

```
##             mpg        cyl       disp         hp        drat         wt
## mpg   1.0000000 -0.8521620 -0.8475514 -0.7761684  0.68117191 -0.8676594
## cyl  -0.8521620  1.0000000  0.9020329  0.8324475 -0.69993811  0.7824958
## disp -0.8475514  0.9020329  1.0000000  0.7909486 -0.71021393  0.8879799
## hp   -0.7761684  0.8324475  0.7909486  1.0000000 -0.44875912  0.6587479
## drat  0.6811719 -0.6999381 -0.7102139 -0.4487591  1.00000000 -0.7124406
## wt   -0.8676594  0.7824958  0.8879799  0.6587479 -0.71244065  1.0000000
## qsec  0.4186840 -0.5912421 -0.4336979 -0.7082234  0.09120476 -0.1747159
## vs    0.6640389 -0.8108118 -0.7104159 -0.7230967  0.44027846 -0.5549157
## am    0.5998324 -0.5226070 -0.5912270 -0.2432043  0.71271113 -0.6924953
## gear  0.4802848 -0.4926866 -0.5555692 -0.1257043  0.69961013 -0.5832870
## carb -0.5509251  0.5269883  0.3949769  0.7498125 -0.09078980  0.4276059
##             qsec         vs          am       gear        carb
## mpg   0.41868403  0.6640389  0.59983243  0.4802848 -0.55092507
## cyl  -0.59124207 -0.8108118 -0.52260705 -0.4926866  0.52698829
## disp -0.43369788 -0.7104159 -0.59122704 -0.5555692  0.39497686
## hp   -0.70822339 -0.7230967 -0.24320426 -0.1257043  0.74981247
## drat  0.09120476  0.4402785  0.71271113  0.6996101 -0.09078980
## wt   -0.17471588 -0.5549157 -0.69249526 -0.5832870  0.42760594
## qsec  1.00000000  0.7445354 -0.22986086 -0.2126822 -0.65624923
## vs    0.74453544  1.0000000  0.16834512  0.2060233 -0.56960714
## am   -0.22986086  0.1683451  1.00000000  0.7940588  0.05753435
## gear -0.21268223  0.2060233  0.79405876  1.0000000  0.27407284
## carb -0.65624923 -0.5696071  0.05753435  0.2740728  1.00000000
```

B. Inspecting data frames and correlations

Base R:

Correlations are in a matrix object

```
storms %>%
  select_if(is.numeric) %>%
  cor()
```

```
##                    year        month           day          hour          lat
## year         1.000000000 -0.011488006  0.0183703369  0.0015741629 -0.121252667
## month       -0.011488006  1.000000000 -0.1830702018 -0.0051201358 -0.065922836
## day          0.018370337 -0.183070202  1.0000000000  0.0007164624 -0.050859874
## hour         0.001574163 -0.005120136  0.0007164624  1.0000000000  0.002682367
## lat         -0.121252667 -0.065922836 -0.0508598742  0.0026823666  1.000000000
## long         0.060387523  0.048382680  0.0406477301 -0.0091876627 -0.104014683
## wind         0.048966015  0.126682358 -0.0064971154  0.0018333102  0.076141764
## pressure    -0.072615741 -0.134238300 -0.0010113895  0.0016030589 -0.103772744
## ts_diameter           NA           NA            NA            NA           NA
## hu_diameter           NA           NA            NA            NA           NA
##                    long         wind     pressure ts_diameter hu_diameter
## year         0.060387523  0.048966015 -0.072615741          NA          NA
## month        0.048382680  0.126682358 -0.134238300          NA          NA
## day          0.040647730 -0.006497115 -0.001011389          NA          NA
## hour        -0.009187663  0.001833310  0.001603059          NA          NA
## lat         -0.104014683  0.076141764 -0.103772744          NA          NA
## long         1.000000000  0.004737422  0.058467333          NA          NA
## wind         0.004737422  1.000000000 -0.942249266          NA          NA
## pressure     0.058467333 -0.942249266  1.000000000          NA          NA
## ts_diameter           NA           NA           NA           1          NA
## hu_diameter           NA           NA           NA          NA           1
```

B. Inspecting data frames and correlations

Base R:

Correlations are in a matrix object

```
storms %>%
  select_if(is.numeric) %>%
  cor(use = "pairwise")
```

```
##                    year        month          day         hour          lat
## year         1.000000000 -0.011488006  0.0183703369  0.0015741629 -0.121252667
## month       -0.011488006  1.000000000 -0.1830702018 -0.0051201358 -0.065922836
## day          0.018370337 -0.183070202  1.0000000000  0.0007164624 -0.050859874
## hour         0.001574163 -0.005120136  0.0007164624  1.0000000000  0.002682367
## lat         -0.121252667 -0.065922836 -0.0508598742  0.0026823666  1.000000000
## long         0.060387523  0.048382680  0.0406477301 -0.0091876627 -0.104014683
## wind         0.048966015  0.126682358 -0.0064971154  0.0018333102  0.076141764
## pressure    -0.072615741 -0.134238300 -0.0010113895  0.0016030589 -0.103772744
## ts_diameter  0.021186700  0.139077211  0.0201075619  0.0085555295  0.300578521
## hu_diameter -0.099658339  0.111651830  0.0338940169  0.0050504779  0.164416787
##                    long         wind     pressure  ts_diameter  hu_diameter
## year         0.060387523  0.048966015 -0.072615741  0.021186700 -0.099658339
## month        0.048382680  0.126682358 -0.134238300  0.139077211  0.111651830
## day          0.040647730 -0.006497115 -0.001011389  0.020107562  0.033894017
## hour        -0.009187663  0.001833310  0.001603059  0.008555529  0.005050478
## lat         -0.104014683  0.076141764 -0.103772744  0.300578521  0.164416787
## long         1.000000000  0.004737422  0.058467333 -0.014605508 -0.102351984
## wind         0.004737422  1.000000000 -0.942249266  0.639640594  0.773608569
## pressure     0.058467333 -0.942249266  1.000000000 -0.683340131 -0.842244047
## ts_diameter -0.014605508  0.639640594 -0.683340131  1.000000000  0.683976179
## hu_diameter -0.102351984  0.773608569 -0.842244047  0.683976179  1.000000000
```

B. Inspecting data frames and correlations

corrr package – `correlate()`

Introduces a new data frame type for correlations

```
library(corrr)

correlate(mtcars)
```

```
## # A tibble: 11 x 12
##    term     mpg    cyl   disp     hp    drat     wt    qsec     vs      am
##    <chr>  <dbl>  <dbl>  <dbl>  <dbl>   <dbl>  <dbl>   <dbl>  <dbl>   <dbl>
##  1 mpg   NA     -0.852 -0.848 -0.776  0.681  -0.868  0.419   0.664  0.600
##  2 cyl   -0.852 NA      0.902  0.832 -0.700   0.782 -0.591  -0.811 -0.523
##  3 disp  -0.848  0.902 NA      0.791 -0.710   0.888 -0.434  -0.710 -0.591
##  4 hp    -0.776  0.832  0.791 NA     -0.449   0.659 -0.708  -0.723 -0.243
##  5 drat   0.681 -0.700 -0.710 -0.449 NA      -0.712  0.0912  0.440  0.713
##  6 wt    -0.868  0.782  0.888  0.659 -0.712  NA     -0.175  -0.555 -0.692
##  7 qsec   0.419 -0.591 -0.434 -0.708  0.0912 -0.175 NA       0.745 -0.230
##  8 vs     0.664 -0.811 -0.710 -0.723  0.440  -0.555  0.745  NA      0.168
##  9 am     0.600 -0.523 -0.591 -0.243  0.713  -0.692 -0.230   0.168 NA
## 10 gear   0.480 -0.493 -0.556 -0.126  0.700  -0.583 -0.213   0.206  0.794
## 11 carb  -0.551  0.527  0.395  0.750 -0.0908  0.428 -0.656  -0.570  0.0575
## # … with 2 more variables: gear <dbl>, carb <dbl>
```

B. Inspecting data frames and correlations

corrr package – Adds some useful features: variable subsets

```
mtcars %>% correlate() %>%
  focus(mpg, cyl, disp)
```

```
## # A tibble: 8 x 4
##   term     mpg    cyl   disp
##   <chr>  <dbl>  <dbl>  <dbl>
## 1 hp    -0.776  0.832  0.791
## 2 drat   0.681 -0.700 -0.710
## 3 wt    -0.868  0.782  0.888
## 4 qsec   0.419 -0.591 -0.434
## 5 vs     0.664 -0.811 -0.710
## 6 am     0.600 -0.523 -0.591
## 7 gear   0.480 -0.493 -0.556
## 8 carb  -0.551  0.527  0.395
```

B. Inspecting data frames and correlations

corrr package – Adds some useful features: neater print output

```
mtcars %>% correlate() %>%
 focus(mpg, cyl, disp) %>%
  fashion()
```

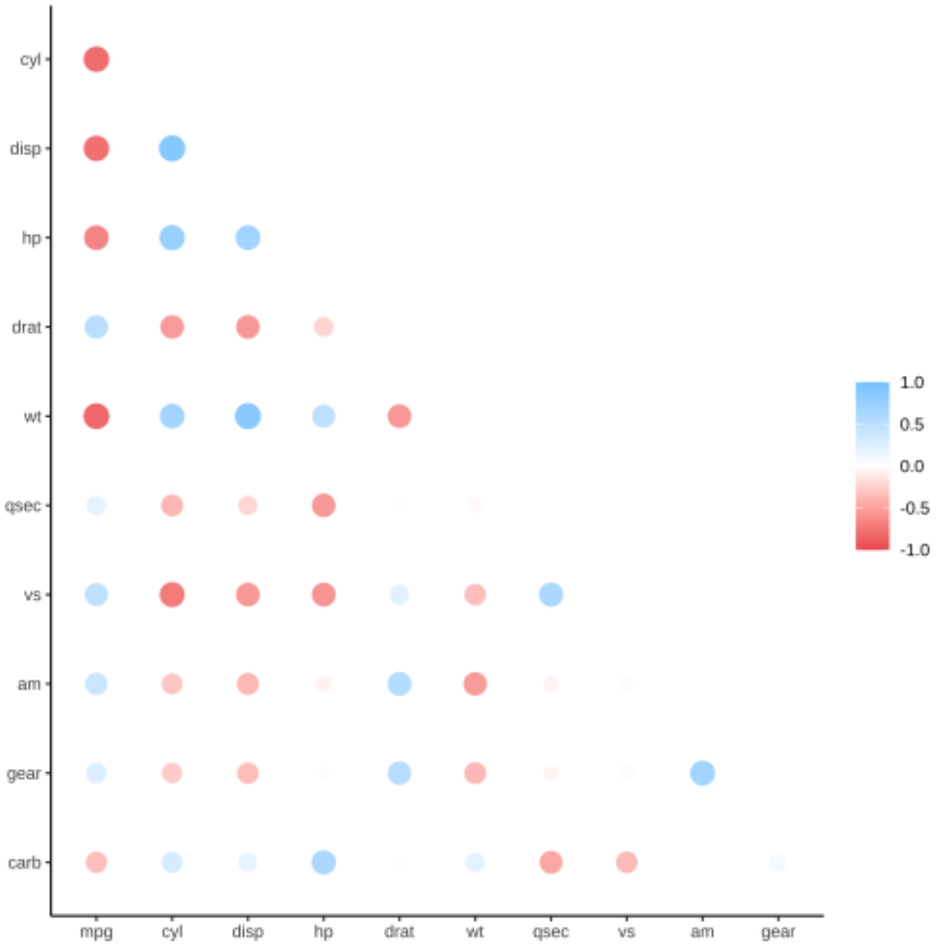
```
##   term  mpg  cyl disp
## 1   hp -.78  .83  .79
## 2 drat  .68 -.70 -.71
## 3   wt -.87  .78  .89
## 4 qsec  .42 -.59 -.43
## 5   vs  .66 -.81 -.71
## 6   am  .60 -.52 -.59
## 7 gear  .48 -.49 -.56
## 8 carb -.55  .53  .39
```

B. Inspecting data frames and correlations

```
mtcars %>% correlate() %>%
  rplot()
```

B. Inspecting data frames and correlations

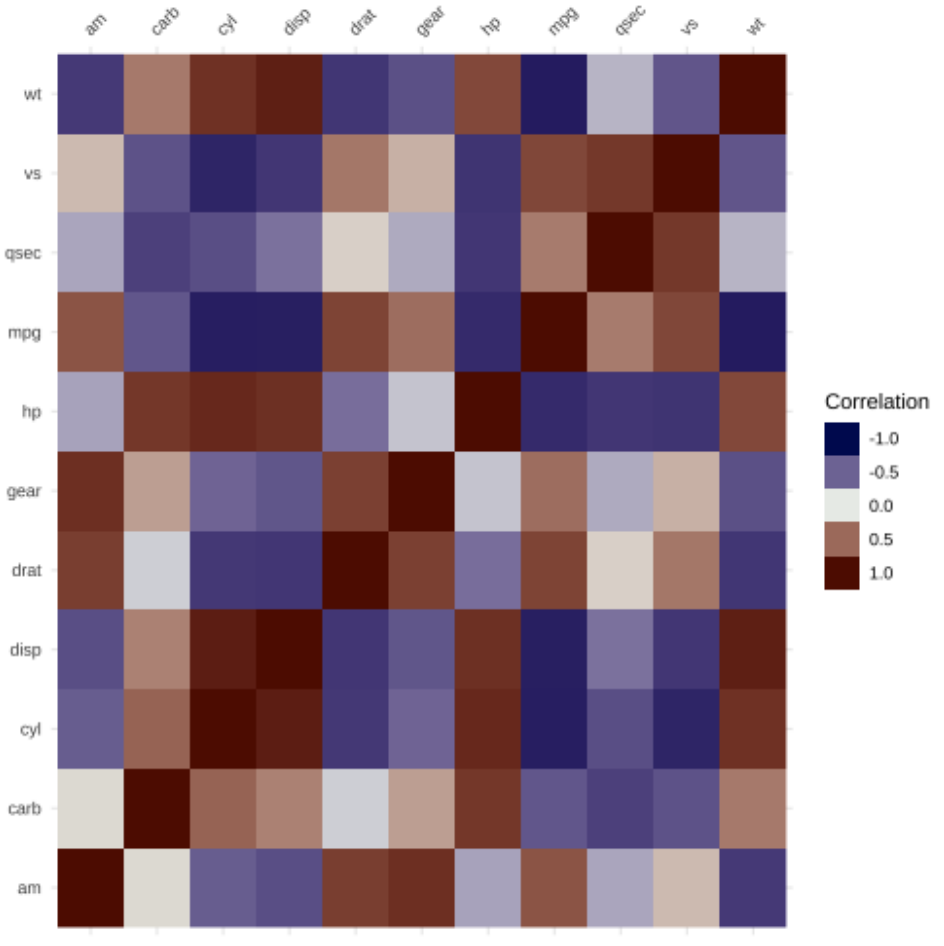
```
mtcars %>% correlate() %>%
  shave() %>%
  rplot()
```



B. Inspecting data frames and correlations

visdat package does correlation heatmaps as well:

```
mtcars %>% vis_cor()
```



C. Summary tables

We also can make some of this summary information neater for our Rmd documents

```
describe(mtcars)
```

```
##      vars  n   mean     sd median trimmed    mad   min    max  range  skew
## mpg     1 32  20.09   6.03  19.20   19.70   5.41 10.40  33.90  23.50  0.61
## cyl     2 32   6.19   1.79   6.00    6.23   2.97  4.00   8.00   4.00 -0.17
## disp    3 32 230.72 123.94 196.30  222.52 140.48 71.10 472.00 400.90  0.38
## hp      4 32 146.69  68.56 123.00  141.19  77.10 52.00 335.00 283.00  0.73
## drat    5 32   3.60   0.53   3.70    3.58   0.70  2.76   4.93   2.17  0.27
## wt      6 32   3.22   0.98   3.33    3.15   0.77  1.51   5.42   3.91  0.42
## qsec    7 32  17.85   1.79  17.71   17.83   1.42 14.50  22.90   8.40  0.37
## vs      8 32   0.44   0.50   0.00    0.42   0.00  0.00   1.00   1.00  0.24
## am      9 32   0.41   0.50   0.00    0.38   0.00  0.00   1.00   1.00  0.36
## gear   10 32   3.69   0.74   4.00    3.62   1.48  3.00   5.00   2.00  0.53
## carb   11 32   2.81   1.62   2.00    2.65   1.48  1.00   8.00   7.00  1.05
##      kurtosis    se
## mpg     -0.37  1.07
## cyl     -1.76  0.32
## disp    -1.21 21.91
## hp      -0.14 12.12
## drat    -0.71  0.09
## wt      -0.02  0.17
## qsec     0.34  0.32
## vs      -2.00  0.09
## am      -1.92  0.09
## gear    -1.07  0.13
## carb     1.26  0.29
```

C. Summary tables

We also can make some of this summary information neater for our Rmd documents

```
library(knitr)
kable(describe(mtcars), digits = 2)
```

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
mpg	1	32	20.09	6.03	19.20	19.70	5.41	10.40	33.90	23.50	0.61	−0.37	1.07
cyl	2	32	6.19	1.79	6.00	6.23	2.97	4.00	8.00	4.00	−0.17	−1.76	0.32
disp	3	32	230.72	123.94	196.30	222.52	140.48	71.10	472.00	400.90	0.38	−1.21	21.91
hp	4	32	146.69	68.56	123.00	141.19	77.10	52.00	335.00	283.00	0.73	−0.14	12.12
drat	5	32	3.60	0.53	3.70	3.58	0.70	2.76	4.93	2.17	0.27	−0.71	0.09
wt	6	32	3.22	0.98	3.33	3.15	0.77	1.51	5.42	3.91	0.42	−0.02	0.17
qsec	7	32	17.85	1.79	17.71	17.83	1.42	14.50	22.90	8.40	0.37	0.34	0.32
vs	8	32	0.44	0.50	0.00	0.42	0.00	0.00	1.00	1.00	0.24	−2.00	0.09
am	9	32	0.41	0.50	0.00	0.38	0.00	0.00	1.00	1.00	0.36	−1.92	0.09
gear	10	32	3.69	0.74	4.00	3.62	1.48	3.00	5.00	2.00	0.53	−1.07	0.13
carb	11	32	2.81	1.62	2.00	2.65	1.48	1.00	8.00	7.00	1.05	1.26	0.29

C. Summary tables

We also can make some of this summary information neater for our Rmd documents

```
cors <- mtcars %>% correlate() %>%
 focus(mpg, cyl, disp) %>%
  fashion()

cors
```

```
##   term  mpg  cyl disp
## 1   hp -.78  .83  .79
## 2 drat  .68 -.70 -.71
## 3   wt -.87  .78  .89
## 4 qsec  .42 -.59 -.43
## 5   vs  .66 -.81 -.71
## 6   am  .60 -.52 -.59
## 7 gear  .48 -.49 -.56
## 8 carb -.55  .53  .39
```

```
kable(cors)
```

term	mpg	cyl	disp
hp	−.78	.83	.79
drat	.68	−.70	−.71
wt	−.87	.78	.89
qsec	.42	−.59	−.43
vs	.66	−.81	−.71
am	.60	−.52	−.59
gear	.48	−.49	−.56
carb	−.55	.53	.39

C. Summary tables

We can also do some additional customizing with `kable()`

```
kable(describe(mtcars), digits = 2, caption = "This is my summary table")
```

Table: This is my summary table

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
mpg	1	32	20.09	6.03	19.20	19.70	5.41	10.40	33.90	23.50	0.61	−0.37	1.07
cyl	2	32	6.19	1.79	6.00	6.23	2.97	4.00	8.00	4.00	−0.17	−1.76	0.32
disp	3	32	230.72	123.94	196.30	222.52	140.48	71.10	472.00	400.90	0.38	−1.21	21.91
hp	4	32	146.69	68.56	123.00	141.19	77.10	52.00	335.00	283.00	0.73	−0.14	12.12
drat	5	32	3.60	0.53	3.70	3.58	0.70	2.76	4.93	2.17	0.27	−0.71	0.09
wt	6	32	3.22	0.98	3.33	3.15	0.77	1.51	5.42	3.91	0.42	−0.02	0.17
qsec	7	32	17.85	1.79	17.71	17.83	1.42	14.50	22.90	8.40	0.37	0.34	0.32
vs	8	32	0.44	0.50	0.00	0.42	0.00	0.00	1.00	1.00	0.24	−2.00	0.09
am	9	32	0.41	0.50	0.00	0.38	0.00	0.00	1.00	1.00	0.36	−1.92	0.09
gear	10	32	3.69	0.74	4.00	3.62	1.48	3.00	5.00	2.00	0.53	−1.07	0.13
carb	11	32	2.81	1.62	2.00	2.65	1.48	1.00	8.00	7.00	1.05	1.26	0.29

C. Summary tables

The kableExtra packages adds more customization options to `kable()`

```
library(kableExtra)
table <- kable(describe(mtcars), digits = 2, caption = "This is my summary table")
row_spec(table, 5, bold = TRUE, background = "yellow") %>%
  footnote("only the highlighted row is important, but you can't have a table with just one row")
```

This is my summary table

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
mpg	1	32	20.09	6.03	19.20	19.70	5.41	10.40	33.90	23.50	0.61	−0.37	1.07
cyl	2	32	6.19	1.79	6.00	6.23	2.97	4.00	8.00	4.00	−0.17	−1.76	0.32
disp	3	32	230.72	123.94	196.30	222.52	140.48	71.10	472.00	400.90	0.38	−1.21	21.91
hp	4	32	146.69	68.56	123.00	141.19	77.10	52.00	335.00	283.00	0.73	−0.14	12.12
drat	**5**	**32**	**3.60**	**0.53**	**3.70**	**3.58**	**0.70**	**2.76**	**4.93**	**2.17**	**0.27**	**−0.71**	**0.09**
wt	6	32	3.22	0.98	3.33	3.15	0.77	1.51	5.42	3.91	0.42	−0.02	0.17
qsec	7	32	17.85	1.79	17.71	17.83	1.42	14.50	22.90	8.40	0.37	0.34	0.32
vs	8	32	0.44	0.50	0.00	0.42	0.00	0.00	1.00	1.00	0.24	−2.00	0.09
am	9	32	0.41	0.50	0.00	0.38	0.00	0.00	1.00	1.00	0.36	−1.92	0.09
gear	10	32	3.69	0.74	4.00	3.62	1.48	3.00	5.00	2.00	0.53	−1.07	0.13
carb	11	32	2.81	1.62	2.00	2.65	1.48	1.00	8.00	7.00	1.05	1.26	0.29

Note:

only the highlighted row is important, but you can't have a table with just one row

C. Summary tables

There are other packages that can customize tables for specific formats

the sjPlot package is particularly useful for producing orderly and nice looking output tables for different kinds of models.

Example: `lm()` summary output

```
library(sjPlot)
model <- lm(mpg ~ disp + cyl, data = mtcars)
```

C. Summary tables

Example: `lm()` print output

```
model <- lm(mpg ~ disp + cyl, data = mtcars)
model
```

```
##
## Call:
## lm(formula = mpg ~ disp + cyl, data = mtcars)
##
## Coefficients:
## (Intercept)         disp          cyl
##    34.66099     -0.02058     -1.58728
```

C. Summary tables

Example: `lm()` summary output

```
model <- lm(mpg ~ disp + cyl, data = mtcars)
summary(model)
```

```
##
## Call:
## lm(formula = mpg ~ disp + cyl, data = mtcars)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.4213 -2.1722 -0.6362  1.1899  7.0516
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 34.66099    2.54700  13.609 4.02e-14 ***
## disp        -0.02058    0.01026  -2.007   0.0542 .
## cyl         -1.58728    0.71184  -2.230   0.0337 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.055 on 29 degrees of freedom
## Multiple R-squared:  0.7596,    Adjusted R-squared:  0.743
## F-statistic: 45.81 on 2 and 29 DF,  p-value: 1.058e-09
```

C. Summary tables

Example: `lm()` sjPlots table output

```
model <- lm(mpg ~ disp + cyl, data = mtcars)
tab_model(model)
```

		mpg	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	34.66	29.45 — 39.87	**<0.001**
disp	−0.02	−0.04 — 0.00	0.054
cyl	−1.59	−3.04 — −0.13	**0.034**
Observations	32		
R^2 / R^2 adjusted	0.760 / 0.743		

C. Summary tables

```
library(apaTables)
apa.cor.table(attitude)
apa.cor.table(attitude, filename="ex-CorTable1.doc")
```

Live coding

Let's head over to the following file for a demonstration: Week 8 demo

Feedback

We're at the middle of the semester

1. What should we keep doing?
2. What should we do more?
3. What should we do less?

Please consider responding this short mid–semester survey/feedback form (completely anonymous): https://forms.gle/wuHkb7TgeZs7HoXd8

Logistics

This week

- Homework 8: Available tomorrow by noon; **Due by Thursday, 3/18**
- Readings https://r4ds.had.co.nz/exploratory-data-analysis.html
- Schedule updated: https://making-data-science-count.github.io/s21-intro-to-data-sci-methods-in-ed/schedule.html

Final Project

- Final project

Wrapping up

In your base group's Slack channel:

- What is one thing you learned today?
- What is something you want to learn more about?
- Share your feelings in GIF form!

We really appreciate being able to see these reactions and get this feedback!