

Assignment 4: Data Wrangling

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OVERVIEW

This exercise accompanies the lessons in Environmental Data Analytics (ENV872L) on data wrangling.

Directions

1. Change “Student Name” on line 3 (above) with your name.
2. Use the lesson as a guide. It contains code that can be modified to complete the assignment.
3. Work through the steps, **creating code and output** that fulfill each instruction.
4. Be sure to **answer the questions** in this assignment document. Space for your answers is provided in this document and is indicated by the “>” character. If you need a second paragraph be sure to start the first line with “>”. You should notice that the answer is highlighted in green by RStudio.
5. When you have completed the assignment, **Knit** the text and code into a single PDF file. You will need to have the correct software installed to do this (see Software Installation Guide) Press the **Knit** button in the RStudio scripting panel. This will save the PDF output in your Assignments folder.
6. After Knitting, please submit the completed exercise (PDF file) to the dropbox in Sakai. Please add your last name into the file name (e.g., “Salk_A04_DataWrangling.pdf”) prior to submission.

The completed exercise is due on Thursday, 7 February, 2019 before class begins.

Set up your session

1. Check your working directory, load the **tidyverse** package, and upload all four raw data files associated with the EPA Air dataset. See the README file for the EPA air datasets for more information (especially if you have not worked with air quality data previously).
2. Generate a few lines of code to get to know your datasets (basic data summaries, etc.).

```
#1
#viewing working dirctory
getwd()

## [1] "/Users/carolinewatson/Documents/Spring 2019/Environmental Data Analytics/Env_Data_Analytics/Ass

#loading tidyvere
suppressMessages(library(tidyverse))
library(knitr)
library(kableExtra)

#uploading raw data files for ozone and PM 2.5
EPA_PM25_2017 <- read.csv("../Data/Raw/EPAair_PM25_NC2017_raw.csv")
EPA_PM25_2018 <- read.csv("../Data/Raw/EPAair_PM25_NC2018_raw.csv")
EPA_O3_2017 <- read.csv("../Data/Raw/EPAair_O3_NC2017_raw.csv")
EPA_O3_2018 <- read.csv("../Data/Raw/EPAair_O3_NC2018_raw.csv")

#2

#summary of dataset for PM2.5 in 2017
head(EPA_PM25_2017)
```

```

##      Date Source   Site.ID POC Daily.Mean.PM2.5.Concentration   UNITS
## 1  1/1/17   AQS 370110002   1                2.9 ug/m3 LC
## 2  1/4/17   AQS 370110002   1                1.2 ug/m3 LC
## 3  1/7/17   AQS 370110002   1                3.2 ug/m3 LC
## 4  1/10/17  AQS 370110002   1                6.4 ug/m3 LC
## 5  1/13/17  AQS 370110002   1                3.6 ug/m3 LC
## 6  1/16/17  AQS 370110002   1                5.8 ug/m3 LC
##      DAILY_AQI_VALUE      Site.Name DAILY_OBS_COUNT PERCENT_COMPLETE
## 1              12 Linville Falls              1              100
## 2              5 Linville Falls              1              100
## 3             13 Linville Falls              1              100
## 4             27 Linville Falls              1              100
## 5             15 Linville Falls              1              100
## 6             24 Linville Falls              1              100
##      AQS_PARAMETER_CODE      AQS_PARAMETER_DESC CBSA_CODE
## 1             88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 2             88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 3             88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 4             88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 5             88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 6             88502 Acceptable PM2.5 AQI & Speciation Mass      NA
##      CBSA_NAME STATE_CODE      STATE COUNTY_CODE COUNTY SITE_LATITUDE
## 1              37 North Carolina              11 Avery      35.97235
## 2              37 North Carolina              11 Avery      35.97235
## 3              37 North Carolina              11 Avery      35.97235
## 4              37 North Carolina              11 Avery      35.97235
## 5              37 North Carolina              11 Avery      35.97235
## 6              37 North Carolina              11 Avery      35.97235
##      SITE_LONGITUDE
## 1             -81.93307
## 2             -81.93307
## 3             -81.93307
## 4             -81.93307
## 5             -81.93307
## 6             -81.93307

```

[summary\(EPA_PM25_2017\)](#)

```

##      Date      Source      Site.ID      POC
## 1/31/17: 45   AQS:9494   Min.      :370110002   Min.      :1.000
## 1/19/17: 44              1st Qu.:370630015   1st Qu.:3.000
## 11/3/17: 44              Median :371010002   Median :3.000
## 2/12/17: 44              Mean   :370980114   Mean    :2.734
## 4/1/17 : 44              3rd Qu.:371210004   3rd Qu.:3.000
## 5/31/17: 44              Max.    :371830021   Max.    :4.000
## (Other):9229
##      Daily.Mean.PM2.5.Concentration      UNITS      DAILY_AQI_VALUE
##      Min.      : -3.900                ug/m3 LC:9494   Min.      : 0.00
##      1st Qu.: 5.000                    1st Qu.:21.00
##      Median : 7.300                    Median :30.00
##      Mean   : 7.742                    Mean   :31.72
##      3rd Qu.:10.000                    3rd Qu.:42.00
##      Max.   :31.900                    Max.   :93.00
##
##      Site.Name      DAILY_OBS_COUNT PERCENT_COMPLETE

```

```

## Board Of Ed. Bldg.      : 542   Min.   :1      Min.   :100
## Hattie Avenue          : 505   1st Qu.:1      1st Qu.:100
## Lexington water tower  : 501   Median :1      Median :100
## Montclair Elementary School: 489   Mean    :1      Mean    :100
## Pitt Agri. Center       : 483   3rd Qu.:1      3rd Qu.:100
## West Johnston Co.       : 478   Max.    :1      Max.    :100
## (Other)                 :6496
## AQS_PARAMETER_CODE      AQS_PARAMETER_DESC
## Min.   :88101      Acceptable PM2.5 AQI & Speciation Mass:2842
## 1st Qu.:88101      PM2.5 - Local Conditions          :6652
## Median :88101
## Mean    :88221
## 3rd Qu.:88502
## Max.    :88502
##
## CBSA_CODE            CBSA_NAME      STATE_CODE
## Min.   :11700      Charlotte-Concord-Gastonia, NC-SC:1411   Min.   :37
## 1st Qu.:16740      Winston-Salem, NC                      :1366   1st Qu.:37
## Median :25860                        :1353   Median :37
## Mean    :30793      Raleigh, NC                            :1285   Mean    :37
## 3rd Qu.:41820      Asheville, NC                          : 657   3rd Qu.:37
## Max.    :49180      Greenville, NC                        : 483   Max.    :37
## NA's    :1353      (Other)                               :2939
##
## STATE      COUNTY_CODE      COUNTY      SITE_LATITUDE
## North Carolina:9494   Min.   : 11   Mecklenburg:1411   Min.   :34.36
##                      1st Qu.: 63   Forsyth      : 865   1st Qu.:35.26
##                      Median :101   Wake         : 807   Median :35.64
##                      Mean    : 98   Buncombe     : 542   Mean    :35.60
##                      3rd Qu.:121   Davidson     : 501   3rd Qu.:35.91
##                      Max.    :183   Pitt         : 483   Max.    :36.11
##                      (Other)   :4885
##
## SITE_LONGITUDE
## Min.   : -83.44
## 1st Qu.: -80.87
## Median : -80.23
## Mean    : -80.03
## 3rd Qu.: -78.82
## Max.    : -76.21
##

```

```
colnames(EPA_PM25_2017)
```

```

## [1] "Date"                "Source"
## [3] "Site.ID"             "POC"
## [5] "Daily.Mean.PM2.5.Concentration" "UNITS"
## [7] "DAILY_AQI_VALUE"     "Site.Name"
## [9] "DAILY_OBS_COUNT"     "PERCENT_COMPLETE"
## [11] "AQS_PARAMETER_CODE"  "AQS_PARAMETER_DESC"
## [13] "CBSA_CODE"           "CBSA_NAME"
## [15] "STATE_CODE"          "STATE"
## [17] "COUNTY_CODE"        "COUNTY"
## [19] "SITE_LATITUDE"       "SITE_LONGITUDE"

```

```
dim(EPA_PM25_2017)
```

```
## [1] 9494 20
```

```
#summary of dataset for PM2.5 in 2018
```

```
head(EPA_PM25_2018)
```

```
##      Date Source   Site.ID POC Daily.Mean.PM2.5.Concentration  UNITS
## 1  1/2/18   AQS 370110002   1                2.9 ug/m3 LC
## 2  1/5/18   AQS 370110002   1                3.7 ug/m3 LC
## 3  1/8/18   AQS 370110002   1                5.3 ug/m3 LC
## 4  1/11/18  AQS 370110002   1                0.8 ug/m3 LC
## 5  1/14/18  AQS 370110002   1                2.5 ug/m3 LC
## 6  1/17/18  AQS 370110002   1                4.5 ug/m3 LC
##      DAILY_AQI_VALUE      Site.Name DAILY_OBS_COUNT PERCENT_COMPLETE
## 1                12 Linville Falls                1             100
## 2                15 Linville Falls                1             100
## 3                22 Linville Falls                1             100
## 4                 3 Linville Falls                1             100
## 5                10 Linville Falls                1             100
## 6                19 Linville Falls                1             100
##      AQS_PARAMETER_CODE      AQS_PARAMETER_DESC CBSA_CODE
## 1                88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 2                88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 3                88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 4                88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 5                88502 Acceptable PM2.5 AQI & Speciation Mass      NA
## 6                88502 Acceptable PM2.5 AQI & Speciation Mass      NA
##      CBSA_NAME STATE_CODE      STATE COUNTY_CODE COUNTY SITE_LATITUDE
## 1                37 North Carolina                11 Avery      35.97235
## 2                37 North Carolina                11 Avery      35.97235
## 3                37 North Carolina                11 Avery      35.97235
## 4                37 North Carolina                11 Avery      35.97235
## 5                37 North Carolina                11 Avery      35.97235
## 6                37 North Carolina                11 Avery      35.97235
##      SITE_LONGITUDE
## 1             -81.93307
## 2             -81.93307
## 3             -81.93307
## 4             -81.93307
## 5             -81.93307
## 6             -81.93307
```

```
summary(EPA_PM25_2018)
```

```
##      Date      Source      Site.ID      POC
## 1/26/18: 39   AirNow: 783   Min.    :370110002   Min.    :1.000
## 2/1/18 : 39   AQS      :6828   1st Qu.:370630015   1st Qu.:3.000
## 2/19/18: 39                Median :371190041   Median :3.000
## 1/14/18: 38                Mean   :371031969   Mean   :3.011
## 1/8/18 : 38                3rd Qu.:371290002   3rd Qu.:3.000
## 2/7/18 : 38                Max.    :371830021   Max.    :5.000
## (Other):7380
##      Daily.Mean.PM2.5.Concentration      UNITS      DAILY_AQI_VALUE
##      Min.      :-2.800                ug/m3 LC:7611   Min.      : 0.00
```

```

## 1st Qu.: 5.000                      1st Qu.:21.00
## Median : 7.200                      Median :30.00
## Mean   : 7.554                      Mean   :31.03
## 3rd Qu.: 9.800                      3rd Qu.:41.00
## Max.    :34.200                    Max.    :97.00
##
##                               Site.Name   DAILY_OBS_COUNT PERCENT_COMPLETE
## Millbrook School      : 621   Min.    :1      Min.    :100
## Board Of Ed. Bldg.    : 428   1st Qu.:1      1st Qu.:100
## Garinger High School  : 421   Median :1      Median :100
## Durham Armory         : 415   Mean    :1      Mean    :100
## Lexington water tower: 411   3rd Qu.:1      3rd Qu.:100
## Pitt Agri. Center     : 409   Max.    :1      Max.    :100
## (Other)                :4906
## AQS_PARAMETER_CODE                               AQS_PARAMETER_DESC
## Min.    :88101      Acceptable PM2.5 AQI & Speciation Mass:1246
## 1st Qu.:88101      PM2.5 - Local Conditions                :6365
## Median :88101
## Mean    :88167
## 3rd Qu.:88101
## Max.    :88502
##
## CBSA_CODE                               CBSA_NAME      STATE_CODE
## Min.    :11700      Raleigh, NC                :1274   Min.    :37
## 1st Qu.:19000      Charlotte-Concord-Gastonia, NC-SC:1171   1st Qu.:37
## Median :25860                               :1025   Median :37
## Mean    :30249      Winston-Salem, NC          : 803   Mean    :37
## 3rd Qu.:39580      Asheville, NC              : 447   3rd Qu.:37
## Max.    :49180      Durham-Chapel Hill, NC     : 415   Max.    :37
## NA's    :1025      (Other)                    :2476
## STATE      COUNTY_CODE      COUNTY      SITE_LATITUDE
## North Carolina:7611   Min.    : 11.0   Mecklenburg:1171   Min.    :34.36
##                               1st Qu.: 63.0   Wake              : 947   1st Qu.:35.26
##                               Median :119.0   Buncombe          : 428   Median :35.64
##                               Mean    :103.2   Durham            : 415   Mean    :35.59
##                               3rd Qu.:129.0   Davidson          : 411   3rd Qu.:35.87
##                               Max.    :183.0   Pitt              : 409   Max.    :36.11
##                               (Other)   :3830
## SITE_LONGITUDE
## Min.    :-83.44
## 1st Qu.: -80.87
## Median  :-79.84
## Mean    :-79.95
## 3rd Qu.: -78.57
## Max.    :-76.21
##

```

```
colnames(EPA_PM25_2018)
```

```

## [1] "Date"                      "Source"
## [3] "Site.ID"                  "POC"
## [5] "Daily.Mean.PM2.5.Concentration" "UNITS"
## [7] "DAILY_AQI_VALUE"         "Site.Name"
## [9] "DAILY_OBS_COUNT"         "PERCENT_COMPLETE"
## [11] "AQS_PARAMETER_CODE"      "AQS_PARAMETER_DESC"

```

```
## [13] "CBSA_CODE"           "CBSA_NAME"
## [15] "STATE_CODE"          "STATE"
## [17] "COUNTY_CODE"        "COUNTY"
## [19] "SITE_LATITUDE"       "SITE_LONGITUDE"
```

```
dim(EPA_PM25_2018)
```

```
## [1] 7611 20
```

```
#summary of dataset for O3 in 2017
```

```
head(EPA_O3_2017)
```

```
##      Date Source   Site.ID POC Daily.Max.8.hour.Ozone.Concentration UNITS
## 1 3/1/17   AQS 370030005 1          0.041 ppm
## 2 3/2/17   AQS 370030005 1          0.046 ppm
## 3 3/3/17   AQS 370030005 1          0.046 ppm
## 4 3/4/17   AQS 370030005 1          0.046 ppm
## 5 3/5/17   AQS 370030005 1          0.046 ppm
## 6 3/6/17   AQS 370030005 1          0.048 ppm
##      DAILY_AQI_VALUE      Site.Name DAILY_OBS_COUNT PERCENT_COMPLETE
## 1              38 Taylorsville Liledoun          17          100
## 2              43 Taylorsville Liledoun          17          100
## 3              43 Taylorsville Liledoun          17          100
## 4              43 Taylorsville Liledoun          17          100
## 5              43 Taylorsville Liledoun          17          100
## 6              44 Taylorsville Liledoun          17          100
##      AQS_PARAMETER_CODE AQS_PARAMETER_DESC CBSA_CODE
## 1              44201          Ozone 25860
## 2              44201          Ozone 25860
## 3              44201          Ozone 25860
## 4              44201          Ozone 25860
## 5              44201          Ozone 25860
## 6              44201          Ozone 25860
##                  CBSA_NAME STATE_CODE      STATE COUNTY_CODE
## 1 Hickory-Lenoir-Morganton, NC      37 North Carolina      3
## 2 Hickory-Lenoir-Morganton, NC      37 North Carolina      3
## 3 Hickory-Lenoir-Morganton, NC      37 North Carolina      3
## 4 Hickory-Lenoir-Morganton, NC      37 North Carolina      3
## 5 Hickory-Lenoir-Morganton, NC      37 North Carolina      3
## 6 Hickory-Lenoir-Morganton, NC      37 North Carolina      3
##      COUNTY SITE_LATITUDE SITE_LONGITUDE
## 1 Alexander      35.9138      -81.191
## 2 Alexander      35.9138      -81.191
## 3 Alexander      35.9138      -81.191
## 4 Alexander      35.9138      -81.191
## 5 Alexander      35.9138      -81.191
## 6 Alexander      35.9138      -81.191
```

```
summary(EPA_O3_2017)
```

```
##      Date      Source      Site.ID      POC
## 4/13/17: 40 AQS:10219 Min. :370030005 Min. :1
## 4/15/17: 40      1st Qu.:370650099 1st Qu.:1
## 4/18/17: 40      Median :371010002 Median :1
## 4/3/17 : 40      Mean :370962005 Mean :1
## 4/5/17 : 40      3rd Qu.:371239991 3rd Qu.:1
```

```

## 4/8/17 : 40 Max. :371990004 Max. :1
## (Other):9979
## Daily.Max.8.hour.Ozone.Concentration UNITS DAILY_AQI_VALUE
## Min. :0.00500 ppm:10219 Min. : 5.00
## 1st Qu.:0.03500 1st Qu.: 32.00
## Median :0.04300 Median : 40.00
## Mean :0.04211 Mean : 39.87
## 3rd Qu.:0.04900 3rd Qu.: 45.00
## Max. :0.07500 Max. :115.00
##
## Site.Name DAILY_OBS_COUNT PERCENT_COMPLETE
## Garinger High School: 358 Min. :13.00 Min. : 76.00
## Blackstone : 355 1st Qu.:17.00 1st Qu.:100.00
## Rockwell : 354 Median :17.00 Median :100.00
## Coweeta : 344 Mean :16.94 Mean : 99.63
## Millbrook School : 339 3rd Qu.:17.00 3rd Qu.:100.00
## Beaufort : 338 Max. :17.00 Max. :100.00
## (Other) :8131
## AQS_PARAMETER_CODE AQS_PARAMETER_DESC CBSA_CODE
## Min. :44201 Ozone:10219 Min. :11700
## 1st Qu.:44201 1st Qu.:16740
## Median :44201 Median :24660
## Mean :44201 Mean :27541
## 3rd Qu.:44201 3rd Qu.:39580
## Max. :44201 Max. :49180
## NA's :2541
## CBSA_NAME STATE_CODE
## :2541 Min. :37
## Charlotte-Concord-Gastonia, NC-SC:1428 1st Qu.:37
## Asheville, NC : 940 Median :37
## Winston-Salem, NC : 725 Mean :37
## Raleigh, NC : 584 3rd Qu.:37
## Durham-Chapel Hill, NC : 486 Max. :37
## (Other) :3515
## STATE COUNTY_CODE COUNTY
## North Carolina:10219 Min. : 3.00 Forsyth : 725
## 1st Qu.: 65.00 Haywood : 700
## Median :101.00 Mecklenburg: 601
## Mean : 96.07 Avery : 541
## 3rd Qu.:123.00 Cumberland : 464
## Max. :199.00 Swain : 429
## (Other) :6759
## SITE_LATITUDE SITE_LONGITUDE
## Min. :34.36 Min. : -83.80
## 1st Qu.:35.26 1st Qu.: -82.05
## Median :35.55 Median : -80.23
## Mean :35.60 Mean : -80.32
## 3rd Qu.:35.99 3rd Qu.: -78.77
## Max. :36.31 Max. : -76.62
##

```

```
colnames(EPA_03_2017)
```

```

## [1] "Date"
## [2] "Source"

```

```
## [3] "Site.ID"
## [4] "POC"
## [5] "Daily.Max.8.hour.Ozone.Concentration"
## [6] "UNITS"
## [7] "DAILY_AQI_VALUE"
## [8] "Site.Name"
## [9] "DAILY_OBS_COUNT"
## [10] "PERCENT_COMPLETE"
## [11] "AQS_PARAMETER_CODE"
## [12] "AQS_PARAMETER_DESC"
## [13] "CBSA_CODE"
## [14] "CBSA_NAME"
## [15] "STATE_CODE"
## [16] "STATE"
## [17] "COUNTY_CODE"
## [18] "COUNTY"
## [19] "SITE_LATITUDE"
## [20] "SITE_LONGITUDE"
```

```
dim(EPA_O3_2017)
```

```
## [1] 10219    20
```

```
#summary of dataset for O3 in 2018
```

```
head(EPA_O3_2018)
```

```
##      Date Source   Site.ID POC Daily.Max.8.hour.Ozone.Concentration UNITS
## 1 2/16/18 AirNow 370030005    1                0.038      ppm
## 2 2/17/18 AirNow 370030005    1                0.033      ppm
## 3 2/18/18 AirNow 370030005    1                0.040      ppm
## 4 2/19/18 AirNow 370030005    1                0.020      ppm
## 5 2/20/18 AirNow 370030005    1                0.019      ppm
## 6 2/21/18 AirNow 370030005    1                0.021      ppm
##   DAILY_AQI_VALUE      Site.Name DAILY_OBS_COUNT PERCENT_COMPLETE
## 1                35 Taylorsville Liledoun          24          100
## 2                31 Taylorsville Liledoun          24          100
## 3                37 Taylorsville Liledoun          24          100
## 4                19 Taylorsville Liledoun          24          100
## 5                18 Taylorsville Liledoun          24          100
## 6                19 Taylorsville Liledoun          24          100
##   AQS_PARAMETER_CODE AQS_PARAMETER_DESC CBSA_CODE
## 1                44201              Ozone 25860
## 2                44201              Ozone 25860
## 3                44201              Ozone 25860
## 4                44201              Ozone 25860
## 5                44201              Ozone 25860
## 6                44201              Ozone 25860
##           CBSA_NAME STATE_CODE      STATE COUNTY_CODE
## 1 Hickory-Lenoir-Morganton, NC    37 North Carolina      3
## 2 Hickory-Lenoir-Morganton, NC    37 North Carolina      3
## 3 Hickory-Lenoir-Morganton, NC    37 North Carolina      3
## 4 Hickory-Lenoir-Morganton, NC    37 North Carolina      3
## 5 Hickory-Lenoir-Morganton, NC    37 North Carolina      3
## 6 Hickory-Lenoir-Morganton, NC    37 North Carolina      3
##           COUNTY SITE_LATITUDE SITE_LONGITUDE
## 1 Alexander      35.9138      -81.191
```



```
## 2 Alexander      35.9138      -81.191
## 3 Alexander      35.9138      -81.191
## 4 Alexander      35.9138      -81.191
## 5 Alexander      35.9138      -81.191
## 6 Alexander      35.9138      -81.191
```

```
summary(EPA_03_2018)
```

```
##      Date      Source      Site.ID      POC
## 3/10/18: 39 AirNow:2718 Min. :370030005 Min. :1
## 3/11/18: 39 AQS :8063 1st Qu.:370630015 1st Qu.:1
## 3/13/18: 39      Median :370870036 Median :1
## 3/14/18: 39      Mean :370959550 Mean :1
## 3/15/18: 39      3rd Qu.:371290002 3rd Qu.:1
## 3/16/18: 39      Max. :371990004 Max. :1
## (Other):10547
## Daily.Max.8.hour.Ozone.Concentration UNITS      DAILY_AQI_VALUE
## Min. :0.00000      ppm:10781 Min. : 0.00
## 1st Qu.:0.03400      1st Qu.: 31.00
## Median :0.04100      Median : 38.00
## Mean :0.04124      Mean : 39.46
## 3rd Qu.:0.04900      3rd Qu.: 45.00
## Max. :0.07700      Max. :122.00
##
##      Site.Name      DAILY_OBS_COUNT PERCENT_COMPLETE
## Coweeta : 340 Min. :12.00 Min. : 71.00
## Millbrook School : 338 1st Qu.:17.00 1st Qu.:100.00
## Candor : 337 Median :17.00 Median :100.00
## Garinger High School: 333 Mean :18.69 Mean : 99.62
## Bethany sch. : 332 3rd Qu.:18.00 3rd Qu.:100.00
## Cranberry : 319 Max. :24.00 Max. :100.00
## (Other) :8782
## AQS_PARAMETER_CODE AQS_PARAMETER_DESC CBSA_CODE
## Min. :44201 Ozone:10781 Min. :11700
## 1st Qu.:44201 1st Qu.:16740
## Median :44201 Median :24660
## Mean :44201 Mean :27015
## 3rd Qu.:44201 3rd Qu.:39580
## Max. :44201 Max. :49180
## NA's :2802
##      CBSA_NAME      STATE_CODE
## :2802 Min. :37
## Charlotte-Concord-Gastonia, NC-SC:1469 1st Qu.:37
## Asheville, NC :1159 Median :37
## Winston-Salem, NC : 754 Mean :37
## Raleigh, NC : 636 3rd Qu.:37
## Greensboro-High Point, NC : 595 Max. :37
## (Other) :3366
##      STATE      COUNTY_CODE      COUNTY
## North Carolina:10781 Min. : 3.00 Haywood : 879
## 1st Qu.: 63.00 Forsyth : 754
## Median : 87.00 Mecklenburg: 632
## Mean : 95.84 Avery : 613
## 3rd Qu.:129.00 Cumberland : 467
## Max. :199.00 Swain : 447
```

```
##                               (Other)      :6989
## SITE_LATITUDE  SITE_LONGITUDE
## Min.      :34.36  Min.      :-83.80
## 1st Qu.    :35.26  1st Qu.   :-82.05
## Median     :35.59  Median    :-80.34
## Mean       :35.63  Mean      :-80.39
## 3rd Qu.    :36.03  3rd Qu.   :-78.90
## Max.       :36.31  Max.      :-76.62
##
```

```
colnames(EPA_03_2018)
```

```
## [1] "Date"
## [2] "Source"
## [3] "Site.ID"
## [4] "POC"
## [5] "Daily.Max.8.hour.Ozone.Concentration"
## [6] "UNITS"
## [7] "DAILY_AQI_VALUE"
## [8] "Site.Name"
## [9] "DAILY_OBS_COUNT"
## [10] "PERCENT_COMPLETE"
## [11] "AQS_PARAMETER_CODE"
## [12] "AQS_PARAMETER_DESC"
## [13] "CBSA_CODE"
## [14] "CBSA_NAME"
## [15] "STATE_CODE"
## [16] "STATE"
## [17] "COUNTY_CODE"
## [18] "COUNTY"
## [19] "SITE_LATITUDE"
## [20] "SITE_LONGITUDE"
```

```
dim(EPA_03_2018)
```

```
## [1] 10781    20
```

Wrangle individual datasets to create processed files.

3. Change date to date
4. Select the following columns: Date, DAILY_AQI_VALUE, Site.Name, AQS_PARAMETER_DESC, COUNTY, SITE_LATITUDE, SITE_LONGITUDE
5. For the PM2.5 datasets, fill all cells in AQS_PARAMETER_DESC with “PM2.5” (all cells in this column should be identical).
6. Save all four processed datasets in the Processed folder.

```
#3
#changing the date to date for all 4 data files
EPA_03_2017$Date <- as.Date(EPA_03_2017$Date, format = "%m/%d/%y")
EPA_03_2018$Date <- as.Date(EPA_03_2018$Date, format = "%m/%d/%y")

EPA_PM25_2017$Date <- as.Date(EPA_PM25_2017$Date, format = "%m/%d/%y")
EPA_PM25_2018$Date <- as.Date(EPA_PM25_2018$Date, format = "%m/%d/%y")

#4
```

```

#selecting Date, DAILY_AQI_VALUE, Site.Name, AQS_PARAMETER_DESC, COUNTY, SITE_LATITUDE, SITE_LONGITUDE
EPA_O3_2017 <- select(EPA_O3_2017, Date, DAILY_AQI_VALUE,
  Site.Name, AQS_PARAMETER_DESC, COUNTY, SITE_LATITUDE,
  SITE_LONGITUDE)

#selecting columns for EPA ozone data for 2018
EPA_O3_2018 <- select(EPA_O3_2018, Date, DAILY_AQI_VALUE,
  Site.Name, AQS_PARAMETER_DESC, COUNTY, SITE_LATITUDE,
  SITE_LONGITUDE)

#selecting columns for EPA PM 2.5 2017
EPA_PM25_2017 <- select(EPA_PM25_2017, Date, DAILY_AQI_VALUE,
  Site.Name, AQS_PARAMETER_DESC, COUNTY, SITE_LATITUDE,
  SITE_LONGITUDE)

#selecting columns for EPA PM 2.5 2018
EPA_PM25_2018 <- select(EPA_PM25_2018, Date, DAILY_AQI_VALUE,
  Site.Name, AQS_PARAMETER_DESC, COUNTY, SITE_LATITUDE,
  SITE_LONGITUDE)

#5 Fill all cells in AQS_PARAMETER_DESC with "PM2.5"
EPA_PM25_2017$AQS_PARAMETER_DESC <- c("PM2.5")

EPA_PM25_2018$AQS_PARAMETER_DESC <- c("PM2.5")

#6 write.csv for all four files
write.csv(EPA_O3_2017, row.names = FALSE, file = "../Data/Processed/EPA_O3_2017_Processed.csv")

write.csv(EPA_O3_2018, row.names = FALSE, file = "../Data/Processed/EPA_O3_2018_Processed.csv")

write.csv(EPA_PM25_2017, row.names = FALSE, file = "../Data/Processed/EPA_PM25_2017_Processed.csv")

write.csv(EPA_PM25_2018, row.names = FALSE, file = "../Data/Processed/EPA_PM25_2018_Processed.csv")

```

Combine datasets

7. Combine the four datasets with `rbind`. Make sure your column names are identical prior to running this code. `#combine into one dataset, or combine EPA O3 datasets and EPA pm25 datasets?`
8. Wrangle your new dataset with a pipe function (`%>%`) so that it fills the following conditions:
 - Sites: Blackstone, Bryson City, Triple Oak
 - Add columns for “Month” and “Year” by parsing your “Date” column (hint: `separate` function or `lubridate` package)
9. Spread your datasets such that AQI values for ozone and PM2.5 are in separate columns. Each location on a specific date should now occupy only one row.
10. Call up the dimensions of your new tidy dataset.
11. Save your processed dataset with the following file name: “EPAair_O3_PM25_NC1718_Processed.csv”

```

#7
#reading in processed files
EPA_O3_2017_processed <- read.csv("../Data/Processed/EPA_O3_2017_Processed.csv")
EPA_O3_2018_processed <- read.csv("../Data/Processed/EPA_O3_2018_Processed.csv")
EPA_PM25_2017_processed <- read.csv("../Data/Processed/EPA_PM25_2017_Processed.csv")

```

```
EPA_PM25_2018_processed <- read.csv("../Data/Processed/EPA_PM25_2018_Processed.csv")
```

```
#checking column names of all four datasets
```

```
colnames(EPA_03_2017_processed)
```

```
## [1] "Date"           "DAILY_AQI_VALUE" "Site.Name"
## [4] "AQS_PARAMETER_DESC" "COUNTY"         "SITE_LATITUDE"
## [7] "SITE_LONGITUDE"
```

```
colnames(EPA_03_2018_processed)
```

```
## [1] "Date"           "DAILY_AQI_VALUE" "Site.Name"
## [4] "AQS_PARAMETER_DESC" "COUNTY"         "SITE_LATITUDE"
## [7] "SITE_LONGITUDE"
```

```
colnames(EPA_PM25_2017_processed)
```

```
## [1] "Date"           "DAILY_AQI_VALUE" "Site.Name"
## [4] "AQS_PARAMETER_DESC" "COUNTY"         "SITE_LATITUDE"
## [7] "SITE_LONGITUDE"
```

```
colnames(EPA_PM25_2018_processed)
```

```
## [1] "Date"           "DAILY_AQI_VALUE" "Site.Name"
## [4] "AQS_PARAMETER_DESC" "COUNTY"         "SITE_LATITUDE"
## [7] "SITE_LONGITUDE"
```

```
#all column names are identical, so combining all datasets using rbind
```

```
EPA_Air_data_combined <- rbind(EPA_03_2017_processed,
  EPA_03_2018_processed, EPA_PM25_2017_processed,
  EPA_PM25_2018_processed)
```

```
#install.packages(lubridate)
```

```
library(lubridate)
```

```
##
```

```
## Attaching package: 'lubridate'
```

```
## The following object is masked from 'package:base':
```

```
##
```

```
## date
```

```
#8 Wrangle dataset with pipe functions
```

```
EPA_Air_summaries <- EPA_Air_data_combined %>%
```

```
  filter(Site.Name == "Blackstone" | Site.Name == "Bryson City" | Site.Name == "Triple Oak") %>%
  mutate_at(vars(Date), funs(month, year))
```

```
#9 spread datasets so that AQI values for ozone and PM2.5 are in separate columns
```

```
EPA_Air_summaries_spread <- spread(EPA_Air_summaries, AQS_PARAMETER_DESC, DAILY_AQI_VALUE)
```

```
#10 call up the dimensions of your new tidy dataset
```

```
dim(EPA_Air_summaries_spread)
```

```
## [1] 1953    9
```

```
#11 saving processed data set with filename:"EPAair_03_PM25_NC1718_Processed.csv"
```

```
write.csv(EPA_Air_summaries_spread, row.names = FALSE, file = "../Data/Processed/EPAair_03_PM25_NC1718_
```

Generate summary tables

12. Use the split-apply-combine strategy to generate two new data frames:

- A summary table of mean AQI values for O3 and PM2.5 by month
- A summary table of the mean, minimum, and maximum AQI of O3 and PM2.5 for each site (AQI values, not concentration values)

13. Display the data frames.

```
#12a
#using split-apply-combine to generate summary table of mean AQI values for O3 and PM2.5 by month
EPA_Air_O3_PM25_mean_AQI <- EPA_Air_summaries_spread %>%
  group_by(month) %>%
  filter(!is.na(Ozone) & !is.na(PM2.5)) %>%
  summarise(mean_O3 = mean(Ozone),
            mean_PM25 = mean(PM2.5))

#12b
EPA_Air_O3_PM25_summary <- EPA_Air_summaries_spread %>%
  group_by(Site.Name) %>%
  filter(!is.na(Ozone) & !is.na(PM2.5)) %>%
  summarise(mean_O3 = mean(Ozone),
            mean_PM2.5 = mean(PM2.5),
            min_O3 = min(Ozone),
            min_PM2.5 = min(PM2.5),
            max_O3 = max(Ozone),
            max_PM2.5 = max(PM2.5))

#13
#display the data frames
kable(EPA_Air_O3_PM25_mean_AQI) %>%
  kable_styling()
```

month	mean_O3	mean_PM25
1	31.48276	34.24138
2	35.41176	37.57353
3	42.40164	37.40984
4	43.48598	31.52336
5	39.49057	30.63208
6	39.16981	30.92453
7	38.32787	31.92623
8	34.40449	32.33708
9	32.64000	30.65333
10	32.29412	30.12941
11	30.06897	42.13793
12	29.78378	46.62162

```
kable(EPA_Air_O3_PM25_summary) %>%
  kable_styling()
```

Site.Name	mean_O3	mean_PM2.5	min_O3	min_PM2.5	max_O3	max_PM2.5
Blackstone	38.30237	36.66485	8	0	97	83
Bryson City	35.42769	30.32231	5	3	71	68