Big Data Assignment 1

Due Date: Wednesday, Feb. 20, 2019, before class

A note from your TAs:

Hi! We recognize that this file is a large file and may be a bit overwhelming at first – don't worry! We'll be here to help you with any and all questions you may have. With that being said, there are a couple of house keeping notes:

1. For some of the questions below, you'll see that we've included code chunks underneath the question. This is where you'll type in the code that will be grade. **Please do not** modify the chunk's properties (aka the `results = FALSE`) that you'll see at the top of each chunk. Even with these modifications, you can still run your code and view your specific results.

2. You will also see `<br>` pieces throughout the document. **Please do not** delete these tags, as they are for formatting purposes. If you want to add text to your responses, please ensure that there is an empty line between your last line and any of the `<br>` tags.

3. When you submit your assignment, please just submit this file and rename it `bigdata_asst1_lastname.Rmd`

Thank you so much for reading this, and good luck with the assignment!

Question 1: Using R built-in datasets.

a. Use the R help function to identify 2 built-in datasets. Provide a 1-2 sentence description of one of them. Write down the code to load a built-in dataset for R.

```
#######Q1a#########

#data()  # Outputs all the inbuilt- datasets

AirPassengers

##      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
## 1949 112 118 132 129 121 135 148 148 136 119 104 118
## 1950 115 126 141 135 125 149 170 170 158 133 114 140
## 1951 145 150 178 163 172 178 199 199 184 162 146 166
## 1952 171 180 193 181 183 218 230 242 209 191 172 194
## 1953 196 196 236 235 229 243 264 272 237 211 180 201
## 1954 204 188 235 227 234 264 302 293 259 229 203 229
## 1955 242 233 267 269 270 315 364 347 312 274 237 278
## 1956 284 277 317 313 318 374 413 405 355 306 271 306
## 1957 315 301 356 348 355 422 465 467 404 347 305 336
## 1958 340 318 362 348 363 435 491 505 404 359 310 337
## 1959 360 342 406 396 420 472 548 559 463 407 362 405
## 1960 417 391 419 461 472 535 622 606 508 461 390 432

# Monthly Airline Passenger Numbers 1949-1960

USJudgeRatings

##                  CONT INTG DMNR DILG CFMG DECI PREP FAMI ORAL WRIT PHYS
## AARONSON,L.H.     5.7  7.9  7.7  7.3  7.1  7.4  7.1  7.1  7.1  7.0  8.3
## ALEXANDER,J.M.    6.8  8.9  8.8  8.5  7.8  8.1  8.0  8.0  7.8  7.9  8.5
## ARMENTANO,A.J.    7.2  8.1  7.8  7.8  7.5  7.6  7.5  7.5  7.3  7.4  7.9
## BERDON,R.I.       6.8  8.8  8.5  8.8  8.3  8.5  8.7  8.7  8.4  8.5  8.8
## BRACKEN,J.J.      7.3  6.4  4.3  6.5  6.0  6.2  5.7  5.7  5.1  5.3  5.5
## BURNS,E.B.        6.2  8.8  8.7  8.5  7.9  8.0  8.1  8.0  8.0  8.0  8.6
## CALLAHAN,R.J.    10.6  9.0  8.9  8.7  8.5  8.5  8.5  8.5  8.6  8.4  9.1
## COHEN,S.S.        7.0  5.9  4.9  5.1  5.4  5.9  4.8  5.1  4.7  4.9  6.8
## DALY,J.J.         7.3  8.9  8.9  8.7  8.6  8.5  8.4  8.4  8.4  8.5  8.8
## DANNEHY,J.F.      8.2  7.9  6.7  8.1  7.9  8.0  7.9  8.1  7.7  7.8  8.5
## DEAN,H.H.         7.0  8.0  7.6  7.4  7.3  7.5  7.1  7.2  7.1  7.2  8.4
## DEVITA,H.J.       6.5  8.0  7.6  7.2  7.0  7.1  6.9  7.0  7.0  7.1  6.9
## DRISCOLL,P.J.     6.7  8.6  8.2  6.8  6.9  6.6  7.1  7.3  7.2  7.2  8.1
## GRILLO,A.E.       7.0  7.5  6.4  6.8  6.5  7.0  6.6  6.8  6.3  6.6  6.2
## HADDEN,W.L.JR.    6.5  8.1  8.0  8.0  7.9  8.0  7.9  7.8  7.8  7.8  8.4
## HAMILL,E.C.       7.3  8.0  7.4  7.7  7.3  7.3  7.3  7.2  7.1  7.2  8.0
## HEALEY.A.H.       8.0  7.6  6.6  7.2  6.5  6.5  6.8  6.7  6.4  6.5  6.9
## HULL,T.C.         7.7  7.7  6.7  7.5  7.4  7.5  7.1  7.3  7.1  7.3  8.1
## LEVINE,I.         8.3  8.2  7.4  7.8  7.7  7.7  7.7  7.8  7.5  7.6  8.0
## LEVISTER,R.L.     9.6  6.9  5.7  6.6  6.9  6.6  6.2  6.0  5.8  5.8  7.2
## MARTIN,L.F.       7.1  8.2  7.7  7.1  6.6  6.6  6.7  6.7  6.8  6.8  7.5
## MCGRATH,J.F.      7.6  7.3  6.9  6.8  6.7  6.8  6.4  6.3  6.3  6.3  7.4
## MIGNONE,A.F.      6.6  7.4  6.2  6.2  5.4  5.7  5.8  5.9  5.2  5.8  4.7
## MISSAL,H.M.       6.2  8.3  8.1  7.7  7.4  7.3  7.3  7.3  7.2  7.3  7.8
## MULVEY,H.M.       7.5  8.7  8.5  8.6  8.5  8.4  8.5  8.5  8.4  8.4  8.7
## NARUK,H.J.        7.8  8.9  8.7  8.9  8.7  8.8  8.9  9.0  8.8  8.9  9.0
## O'BRIEN,F.J.      7.1  8.5  8.3  8.0  7.9  7.9  7.8  7.8  7.8  7.7  8.3
## O'SULLIVAN,T.J.   7.5  9.0  8.9  8.7  8.4  8.5  8.4  8.3  8.3  8.3  8.8
## PASKEY,L.         7.5  8.1  7.7  8.2  8.0  8.1  8.2  8.4  8.0  8.1  8.4
## RUBINOW,J.E.      7.1  9.2  9.0  9.0  8.4  8.6  9.1  9.1  8.9  9.0  8.9
## SADEN.G.A.        6.6  7.4  6.9  8.4  8.0  7.9  8.2  8.4  7.7  7.9  8.4
## SATANIELLO,A.G.   8.4  8.0  7.9  7.9  7.8  7.8  7.6  7.4  7.4  7.4  8.1
## SHEA,D.M.         6.9  8.5  7.8  8.5  8.1  8.2  8.4  8.5  8.1  8.3  8.7
## SHEA,J.F.JR.      7.3  8.9  8.8  8.7  8.4  8.5  8.5  8.5  8.4  8.4  8.8
## SIDOR,W.J.        7.7  6.2  5.1  5.6  5.6  5.9  5.6  5.6  5.3  5.5  6.3
## SPEZIALE,J.A.     8.5  8.3  8.1  8.3  8.4  8.2  8.2  8.1  7.9  8.0  8.0
## SPONZO,M.J.       6.9  8.3  8.0  8.1  7.9  7.9  7.9  7.7  7.6  7.7  8.1
## STAPLETON,J.F.    6.5  8.2  7.7  7.8  7.6  7.7  7.7  7.7  7.5  7.6  8.5
## TESTO,R.J.       8.3  7.3  7.0  6.8  7.0  7.1  6.7  6.7  6.7  6.7  8.0
## TIERNEY,W.L.JR.  8.3  8.2  7.8  8.3  8.4  8.3  7.7  7.6  7.5  7.7  8.1
## WALL,R.A.        9.0  7.0  5.9  7.0  7.0  7.2  6.9  6.9  6.5  6.6  7.6
## WRIGHT,D.B.      7.1  8.4  8.4  7.7  7.5  7.7  7.8  8.2  8.0  8.1  8.3
## ZARRILLI,K.J.    8.6  7.4  7.0  7.5  7.5  7.7  7.4  7.2  6.9  7.0  7.8
##                 RTEN
## AARONSON,L.H.    7.8
## ALEXANDER,J.M.   8.7
## ARMENTANO,A.J.   7.8
## BERDON,R.I.      8.7
## BRACKEN,J.J.     4.8
## BURNS,E.B.       8.6
## CALLAHAN,R.J.    9.0
## COHEN,S.S.       5.0
## DALY,J.J.        8.8
## DANNEHY,J.F.     7.9
## DEAN,H.H.        7.7
## DEVITA,H.J.      7.2
## DRISCOLL,P.J.    7.7
## GRILLO,A.E.      6.5
## HADDEN,W.L.JR.   8.0
## HAMILL,E.C.      7.6
## HEALEY.A.H.      6.7
## HULL,T.C.        7.4
## LEVINE,I.        8.0
## LEVISTER,R.L.    6.0
## MARTIN,L.F.      7.3
## MCGRATH,J.F.     6.6
## MIGNONE,A.F.     5.2
## MISSAL,H.M.      7.6
## MULVEY,H.M.      8.7
## NARUK,H.J.       9.0
## O'BRIEN,F.J.     8.2
## O'SULLIVAN,T.J.  8.7
## PASKEY,L.        8.1
## RUBINOW,J.E.     9.2
## SADEN.G.A.       7.5
## SATANIELLO,A.G.  7.9
## SHEA,D.M.        8.3
## SHEA,J.F.JR.     8.8
## SIDOR,W.J.       5.3
## SPEZIALE,J.A.    8.2
## SPONZO,M.J.      8.0
## STAPLETON,J.F.   7.7
## TESTO,R.J.       7.0
## TIERNEY,W.L.JR.  7.9
## WALL,R.A.        6.6
## WRIGHT,D.B.      8.1
## ZARRILLI,K.J.    7.1
```

```
# Lawyers' Ratings of State Judges in the US Superior Court
```

Use the R dataset â Seatbeltsâ to answer the following:

b. What does the dataset contain? There are several ways to figure this out. Use two different ways. One way is just to type â Seatbeltsâ at the R prompt. Other commands to explore are `str( )`, `summary( )`, `dim( )`, `nrow()`, and `ncol( )` where you put the name of the database within the parenthesis. Apply each of these functions to Seatbelts. Furthermore, apply `is.na()` and `is.null()` to check to see if there are any missing data from our datasets.

```
#######Q1b#########

Seatbelts

##          DriversKilled drivers front rear   kms PetrolPrice VanKilled law
## Jan 1969           107    1687   867  269  9059  0.10297181        12   0
## Feb 1969            97    1508   825  265  7685  0.10236300         6   0
## Mar 1969           102    1507   806  319  9963  0.10206249        12   0
## Apr 1969            87    1385   814  407 10955  0.10087330         8   0
## May 1969           119    1632   991  454 11823  0.10101967        10   0
## Jun 1969           106    1511   945  427 12391  0.10058119        13   0
## Jul 1969           110    1559  1004  522 13460  0.10377398        11   0
## Aug 1969           106    1630  1091  536 14055  0.10407640         6   0
## Sep 1969           107    1579   958  405 12106  0.10377398        10   0
## Oct 1969           134    1653   850  437 11372  0.10302640        16   0
## Nov 1969           147    2152  1109  434  9834  0.10273011        13   0
## Dec 1969           180    2148  1113  437  9267  0.10199719        14   0
## Jan 1970           125    1752   925  316  9130  0.10127456        14   0
## Feb 1970           134    1765   903  311  8933  0.10070398         6   0
## Mar 1970           110    1717  1006  351 11000  0.10013961         8   0
## Apr 1970           102    1558   892  362 10733  0.09862110        11   0
## May 1970           103    1575   990  486 12912  0.09834929         7   0
## Jun 1970           111    1520   866  429 12926  0.09808018        13   0
## Jul 1970           120    1805  1095  551 13990  0.09727921        13   0
## Aug 1970           129    1800  1204  646 14926  0.09741062        11   0
## Sep 1970           122    1719  1029  456 12900  0.09742524        11   0
## Oct 1970           183    2008  1147  475 12034  0.09638063        14   0
## Nov 1970           169    2242  1171  456 10643  0.09573896        16   0
## Dec 1970           190    2478  1299  468 10742  0.09510631        14   0
## Jan 1971           134    2030   944  356 10266  0.09673597        17   0
## Feb 1971           108    1655   874  271 10281  0.09610922        16   0
## Mar 1971           104    1693   840  354 11527  0.09536725        15   0
## Apr 1971           117    1623   893  427 12281  0.09470959        13   0
## May 1971           157    1805  1007  465 13587  0.09411762        13   0
## Jun 1971           148    1746   973  440 13049  0.09353215        15   0
## Jul 1971           130    1795  1097  539 16055  0.09295405        12   0
## Aug 1971           140    1926  1194  646 15220  0.09283979         6   0
## Sep 1971           136    1619   988  457 13824  0.09272474         9   0
## Oct 1971           140    1992  1077  446 12729  0.09226965        13   0
## Nov 1971           187    2233  1045  402 11467  0.09170669        14   0
## Dec 1971           150    2192  1115  441 11351  0.09126207        15   0
## Jan 1972           159    2080  1005  359 10803  0.09071160        14   0
## Feb 1972           143    1768   857  334 10548  0.09027633         3   0
## Mar 1972           114    1835   879  312 12368  0.08995192        12   0
## Apr 1972           127    1569   887  427 13311  0.08909964        13   0
## May 1972           159    1976  1075  434 13885  0.08867919        12   0
## Jun 1972           156    1853  1121  486 14088  0.08815929         8   0
## Jul 1972           138    1965  1190  569 16932  0.08890206         8   0
## Aug 1972           120    1689  1058  523 16164  0.08818133        15   0
## Sep 1972           117    1778   939  418 14883  0.08894029         8   0
## Oct 1972           170    1976  1074  452 13532  0.08772661         5   0
## Nov 1972           168    2397  1089  462 12220  0.08742885        17   0
## Dec 1972           198    2654  1208  497 12025  0.08703543        14   0
## Jan 1973           144    2097   903  354 11692  0.08644992        13   0
## Feb 1973           146    1963   916  347 11081  0.08587264         5   0
## Mar 1973           109    1677   787  276 13745  0.08539822         8   0
## Apr 1973           131    1941  1114  472 14382  0.08382198         5   0
## May 1973           151    2003  1014  487 14391  0.08459078        12   0
## Jun 1973           140    1813  1022  505 15597  0.08413690        11   0
## Jul 1973           153    2012  1114  619 16834  0.08377841        13   0
## Aug 1973           140    1912  1132  640 17282  0.08351074        15   0
## Sep 1973           161    2084  1111  559 15779  0.08280639        11   0
## Oct 1973           168    2080  1008  453 13946  0.08117889        11   0
## Nov 1973           152    2118   916  418 12701  0.08285361        10   0
## Dec 1973           136    2150   992  419 10431  0.09419012        13   0
## Jan 1974           113    1608   731  262 11616  0.09239984         8   0
## Feb 1974           100    1503   665  299 10808  0.10816148         6   0
## Mar 1974           103    1548   724  303 12421  0.10721169         8   0
## Apr 1974           103    1382   744  401 13605  0.11404297        14   0
## May 1974           121    1731   910  413 14455  0.11245412        12   0
## Jun 1974           134    1798   883  426 15019  0.11131625        14   0
## Jul 1974           133    1779   900  516 15662  0.11030125        13   0
## Aug 1974           129    1887  1057  600 16745  0.10819718         9   0
## Sep 1974           144    2004  1076  459 14717  0.10702744         4   0
## Oct 1974           154    2077   919  443 13756  0.10494698        13   0
## Nov 1974           156    2092   920  412 12531  0.11935775         6   0
## Dec 1974           163    2051   953  400 12568  0.11762190        15   0
## Jan 1975           122    1577   664  278 11249  0.13302742        12   0
## Feb 1975            92    1356   607  302 11096  0.13084524        16   0
## Mar 1975           117    1652   777  381 12637  0.12831848         7   0
## Apr 1975            95    1382   633  279 13018  0.12354745        12   0
## May 1975            96    1519   791  442 15005  0.11858681        10   0
## Jun 1975           108    1421   790  409 15235  0.11633748         9   0
## Jul 1975           108    1442   803  416 15552  0.11516148         9   0
## Aug 1975           106    1543   884  511 16905  0.11450120         6   0
## Sep 1975           140    1656   769  393 14776  0.11352298         7   0
## Oct 1975           114    1561   732  345 14104  0.11193018        13   0
## Nov 1975           158    1905   859  391 12854  0.11061053        14   0
## Dec 1975           161    2199   994  470 12956  0.11527439        13   0
## Jan 1976           102    1473   704  266 12177  0.11379349        14   0
## Feb 1976           127    1655   684  312 11918  0.11234958        11   0
## Mar 1976           125    1407   671  300 13517  0.11175347        11   0
## Apr 1976           101    1395   643  373 14417  0.10964252        10   0
## May 1976            97    1530   771  412 15911  0.10844090         4   0
## Jun 1976           112    1309   644  322 15589  0.10788494         8   0
## Jul 1976           112    1526   828  458 16543  0.10908477         9   0
## Aug 1976           113    1327   748  427 17925  0.10757145        10   0
## Sep 1976           108    1627   767  346 15406  0.10616402        10   0
## Oct 1976           128    1748   825  421 14601  0.10630000         5   0
## Nov 1976           154    1958   810  344 13107  0.10482531        13   0
## Dec 1976           162    2274   986  370 12268  0.10345175        12   0
## Jan 1977           112    1648   714  291 11972  0.10144992        10   0
## Feb 1977            79    1401   567  224 12028  0.10040232         9   0
## Mar 1977            82    1411   616  266 14033  0.09886203         7   0
## Apr 1977           127    1403   678  338 14244  0.10249615         5   0
## May 1977           108    1394   742  298 15287  0.10302743        10   0
## Jun 1977           110    1520   840  386 16954  0.10217891         5   0
## Jul 1977           123    1528   888  479 17361  0.09983664         6   0
## Aug 1977           103    1643   852  473 17694  0.09263669         8   0
## Sep 1977            97    1515   774  332 16222  0.09181496         6   0
## Oct 1977           140    1685   831  391 14969  0.09072430        12   0
## Nov 1977           165    2000   889  370 13624  0.09002121        15   0
## Dec 1977           183    2215  1046  431 13842  0.08933071         7   0
## Jan 1978           148    1956   889  366 12387  0.08844273        14   0
## Feb 1978           111    1462   626  250 11608  0.08835257         4   0
## Mar 1978           116    1563   808  355 15021  0.08675736        10   0
## Apr 1978           115    1459   746  304 14834  0.08499524         8   0
## May 1978           100    1446   754  379 16565  0.08456794         7   0
## Jun 1978           106    1622   865  440 16882  0.08443190        11   0
## Jul 1978           134    1657   980  500 18012  0.08435088         3   0
## Aug 1978           125    1638   959  511 18855  0.08360098         5   0
## Sep 1978           117    1643   856  384 17243  0.08341726        11   0
## Oct 1978           122    1683   798  366 16045  0.08274514        10   0
## Nov 1978           153    2050   942  432 14745  0.08523527        10   0
## Dec 1978           178    2262  1010  390 13726  0.08477030         7   0
## Jan 1979           114    1813   796  306 11196  0.08445892        10   0
## Feb 1979            94    1445   643  232 12105  0.08535212        11   0
## Mar 1979           128    1762   794  342 14723  0.08755921         9   0
## Apr 1979           119    1461   750  329 15582  0.09038292         7   0
## May 1979           111    1556   809  394 16863  0.09078329         8   0
## Jun 1979           110    1431   716  355 16758  0.10874278        13   0
## Jul 1979           114    1427   851  385 17434  0.11414223         8   0
## Aug 1979           118    1554   931  463 18359  0.11299293         5   0
## Sep 1979           115    1645   834  453 17189  0.11132071         8   0
## Oct 1979           132    1653   762  373 16909  0.10912623         7   0
## Nov 1979           153    2016   880  401 15380  0.10769846        12   0
## Dec 1979           171    2207  1077  466 15161  0.10760157        10   0
## Jan 1980           115    1665   748  306 14027  0.10377502         7   0
## Feb 1980            95    1361   593  263 14478  0.10711417         4   0
## Mar 1980            92    1506   720  323 16155  0.10737477        10   0
## Apr 1980           100    1360   646  310 16585  0.11169537         4   0
## May 1980            95    1453   765  424 18117  0.11063818         8   0
## Jun 1980           114    1522   820  403 17552  0.11185521         8   0
## Jul 1980           102    1460   807  406 18299  0.10974234         7   0
## Aug 1980           104    1552   885  466 19361  0.10819393        10   0
## Sep 1980           132    1548   803  381 17924  0.10625536         8   0
## Oct 1980           136    1827   860  369 17872  0.10419303        14   0
## Nov 1980           117    1737   825  378 16058  0.10193397         8   0
## Dec 1980           137    1941   911  392 15746  0.10279382         9   0
## Jan 1981           111    1474   704  284 15226  0.10476034         8   0
## Feb 1981           106    1458   691  316 14932  0.10400254         6   0
## Mar 1981            98    1542   688  321 16846  0.11665552         7   0
## Apr 1981            84    1404   714  358 16854  0.11516148         6   0
## May 1981            94    1522   814  378 18146  0.11298954         5   0
## Jun 1981           105    1385   736  382 17559  0.11386064         4   0
## Jul 1981           123    1641   876  433 18655  0.11911808         5   0
## Aug 1981           109    1510   829  506 19453  0.12448999        10   0
## Sep 1981           130    1681   818  428 17923  0.12322295         7   0
## Oct 1981           153    1938   942  479 17915  0.12067793        10   0
## Nov 1981           134    1868   782  370 16496  0.12104898        12   0
## Dec 1981            99    1726   823  349 13544  0.11696857         7   0
## Jan 1982           115    1456   595  238 13601  0.11275026         4   0
## Feb 1982           104    1445   673  285 15667  0.10807931         5   0
## Mar 1982           131    1456   660  324 17358  0.10883852         6   0
## Apr 1982           108    1365   676  346 18112  0.11129177         4   0
## May 1982           103    1487   755  410 18581  0.11130401         4   0
## Jun 1982           115    1558   815  411 18759  0.11545436         8   0
## Jul 1982           122    1488   867  496 20668  0.11476830         8   0
## Aug 1982           122    1684   933  534 21040  0.11720743         3   0
## Sep 1982           125    1594   798  396 18993  0.11907640         7   0
## Oct 1982           137    1850   950  470 18668  0.11796586        12   0
## Nov 1982           138    1998   825  385 16768  0.11744913         2   0
## Dec 1982           152    2079   911  411 16551  0.11698846         7   0
## Jan 1983           120    1494   619  281 16231  0.11261054         8   0
## Feb 1983            95    1057   426  300 15511  0.11365702         3   1
## Mar 1983           100    1218   475  318 18308  0.11314445         2   1
## Apr 1983            89    1168   556  391 17793  0.11849553         6   1
## May 1983            82    1236   559  398 19205  0.11796940         3   1
## Jun 1983            89    1076   483  337 19162  0.11768661         7   1
## Jul 1983            60    1174   587  477 20997  0.12005924         6   1
## Aug 1983            84    1139   615  422 20705  0.11943775         8   1
## Sep 1983           113    1427   618  495 18759  0.11888127         8   1
## Oct 1983           126    1487   662  471 19240  0.11846236         4   1
## Nov 1983           122    1483   519  368 17504  0.11801660         3   1
## Dec 1983           118    1513   585  345 16591  0.11770662         5   1
## Jan 1984            92    1357   483  296 16224  0.11777609         5   1
## Feb 1984            86    1165   434  319 16670  0.11479699         3   1
## Mar 1984            81    1282   513  349 18539  0.11573525         4   1
## Apr 1984            84    1110   548  375 19759  0.11535626         3   1
## May 1984            87    1297   586  441 19584  0.11481536         6   1
## Jun 1984            90    1185   522  465 19976  0.11477748         6   1
## Jul 1984            79    1222   601  472 21486  0.11493598         7   1
## Aug 1984            96    1284   644  521 21626  0.11479699         5   1
## Sep 1984           122    1444   643  429 20195  0.11409316         7   1
## Oct 1984           120    1575   641  408 19928  0.11646552         7   1
## Nov 1984           137    1737   711  490 18564  0.11602611         4   1
## Dec 1984           154    1763   721  491 18149  0.11606673         7   1
```

```
print('Variables of Seatbelts ')
```

```
## [1] "Variables of Seatbelts "
```

```
str(Seatbelts)
```

```
##  Time-Series [1:192, 1:8] from 1969 to 1985: 107 97 102 87 119 106 110 106
107 134 ...
##  - attr(*, "dimnames")=List of 2
##   ..$ : NULL
##   ..$ : chr [1:8] "DriversKilled" "drivers" "front" "rear" ...
```

```
print('Summary of Seatbelts ')
```

```
## [1] "Summary of Seatbelts "
```

```
summary(Seatbelts)
```

```
##  DriversKilled      drivers         front             rear      
##  Min.   : 60.0   Min.   :1057   Min.   : 426.0   Min.   :224.0  
##  1st Qu.:104.8   1st Qu.:1462   1st Qu.: 715.5   1st Qu.:344.8  
##  Median :118.5   Median :1631   Median : 828.5   Median :401.5  
##  Mean   :122.8   Mean   :1670   Mean   : 837.2   Mean   :401.2  
##  3rd Qu.:138.0   3rd Qu.:1851   3rd Qu.: 950.8   3rd Qu.:456.2  
##  Max.   :198.0   Max.   :2654   Max.   :1299.0   Max.   :646.0  
##       kms         PetrolPrice        VanKilled           law        
##  Min.   : 7685   Min.   :0.08118   Min.   : 2.000   Min.   :0.0000  
##  1st Qu.:12685   1st Qu.:0.09258   1st Qu.: 6.000   1st Qu.:0.0000  
##  Median :14987   Median :0.10448   Median : 8.000   Median :0.0000  
##  Mean   :14994   Mean   :0.10362   Mean   : 9.057   Mean   :0.1198  
##  3rd Qu.:17203   3rd Qu.:0.11406   3rd Qu.:12.000   3rd Qu.:0.0000  
##  Max.   :21626   Max.   :0.13303   Max.   :17.000   Max.   :1.0000
```

```
print('Dimensions of Seatbelts ')
```

```
## [1] "Dimensions of Seatbelts "
```

```
dim(Seatbelts)
```

```
## [1] 192   8
```

```
print('Rows in Seatbelts ')
```

```
## [1] "Rows in Seatbelts "

nrow(Seatbelts)

## [1] 192

print('Cols in Seatbelts ')

## [1] "Cols in Seatbelts "

ncol(Seatbelts)

## [1] 8
```

Seatbelts Dataset conatins multiple time series with columns like Drivers killed , killometers , petrol proice, van killed. It contains 192 rows and 8 columns. Time series is from 1969 - 1985. It is processed dataset, there are no NaN valus and also no null vaues in the dataset.

```
sum(is.na(Seatbelts))

## [1] 0

sum(is.null(Seatbelts))

## [1] 0
```

c. How is the built-in dataset â UKDriversDeathâ different from â Seatbeltsâ ?

```
#######Q1c#########



UKDriverDeaths

##       Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec
## 1969 1687 1508 1507 1385 1632 1511 1559 1630 1579 1653 2152 2148
## 1970 1752 1765 1717 1558 1575 1520 1805 1800 1719 2008 2242 2478
## 1971 2030 1655 1693 1623 1805 1746 1795 1926 1619 1992 2233 2192
## 1972 2080 1768 1835 1569 1976 1853 1965 1689 1778 1976 2397 2654
## 1973 2097 1963 1677 1941 2003 1813 2012 1912 2084 2080 2118 2150
## 1974 1608 1503 1548 1382 1731 1798 1779 1887 2004 2077 2092 2051
## 1975 1577 1356 1652 1382 1519 1421 1442 1543 1656 1561 1905 2199
## 1976 1473 1655 1407 1395 1530 1309 1526 1327 1627 1748 1958 2274
## 1977 1648 1401 1411 1403 1394 1520 1528 1643 1515 1685 2000 2215
## 1978 1956 1462 1563 1459 1446 1622 1657 1638 1643 1683 2050 2262
## 1979 1813 1445 1762 1461 1556 1431 1427 1554 1645 1653 2016 2207
## 1980 1665 1361 1506 1360 1453 1522 1460 1552 1548 1827 1737 1941
## 1981 1474 1458 1542 1404 1522 1385 1641 1510 1681 1938 1868 1726
## 1982 1456 1445 1456 1365 1487 1558 1488 1684 1594 1850 1998 2079
## 1983 1494 1057 1218 1168 1236 1076 1174 1139 1427 1487 1483 1513
## 1984 1357 1165 1282 1110 1297 1185 1222 1284 1444 1575 1737 1763

str(UKDriverDeaths)
```

```
##  Time-Series [1:192] from 1969 to 1985: 1687 1508 1507 1385 1632 ...

print('Summary of UKDriverDeaths ')

## [1] "Summary of UKDriverDeaths "

summary(UKDriverDeaths)

##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    1057    1462    1631    1670    1851    2654
```

Datasets UKDriverDeaths & Seatbelts both are Timeseries data but UKDriverDeaths just have the count of deaths of driver with no other variables whereas in Seatbelts we have more variables in addition to the year and month data.UKDriverDeaths is a time series giving the monthly totals of car drivers in Great Britain killed or seriously injured Jan 1969 to Dec 1984. Compulsory wearing of seat belts was introduced on 31 Jan 1983. Seatbelts is more information on the same problem.

d. What does `Seatbelts[1,1]` return? What does `Seatbelts[29, 5]` return? Describe in 1 sentence what is going on.

```
#######Q1d#########

Seatbelts[1,1]

## DriversKilled
##           107

Seatbelts[29, 5]

##   kms
## 13587
```

`Seatbelts[1,1]` returns the value(107) in cell[1,1] i.e. 1st row and 1st column(DriversKilled) of the dataframe & `Seatbelts[29, 5]` returns the value(13587) in 29th row and 5th column(kms) of the dataframe.

e. If you were interested in analyzing deaths due to car accidents in the UK, describe how you could combine Seatbelts and UKDriversDeath to do so. (You do not need actually do this.)

What I can do is combine datasets and grab the deaths from UKdriverDeaths and combine it with the Front , vankilled over the years of 1969-1985. this will give the deaths in UK with van killed.

f. Create a variable Bob and set it to True. Type Bob and what does R return. (Note that R is case sensitive so â Bobâ does not equal â bobâ .) Type Bob+Bob. What is the result and what is going on?

```
#######Q1f#########

Bob = TRUE

Bob+Bob

## [1] 2
```

Bob is assigned as 'TRUE' which is treated as bolean which is '1' for 'TRUE' & '0' for 'FALSE'. So, when we perform Bob+Bob it returns "2" which is 1+1 in boolean.

g. What is vector recycling in R? (It applies to all vectors not just logical ones.) Create a vector of two logical values and another of 5 logical values. Ask R if those two vectors are equal. What happens and what is going on?

```
#######Q1g#########

a = c(1,0)
b=  c(1,1,1,0,1)

a == b

## Warning in a == b: longer object length is not a multiple of shorter
object
## length

## [1]  TRUE FALSE  TRUE  TRUE  TRUE
```

Vector Recycling in r: If two vectors are of unequal length, the shorter one will be recycled in order to match the longer vector. For example, the following vectors u and v have different lengths, and their sum is computed by recycling values of the shorter vector u.

if the value of "a" matches with Value of 'b' then R returns 'TRUE' otherwise 'FALSE'. Each vale of vector 'a' is been compared with vector 'b'. since 'a' has only 2 elements so for comparing the rest of the elements from 'b , 'a' is been repeated . which means that R compares a(1,0,1,0,1) & b(1,1,1,0,1) which returns "TRUE FALSE TRUE TRUE TRUE"

Question 2: Basic Data Manipulation

a. Download the PUMS dataset from Canvas, file name: psam_p34.csv. This is the Public Use Micro Dataset, a subset from the ACS survey. You can also find on Canvas the definition of variables for this dataset (PUMS_Data_Dictionary_2017). Follow the directions below to import a dataset into RStudio

   - Go to â Fileâ tab at top of Computer Screen

- Under â Import Datasetâ , choose â From Text(base)â
- Navigate to the folder in which dataset is downloaded
- Click Import to continue through with the dataset
- **Note**: R Studio actually provides you with the code to import datasets. Type that code below

```
#######Q2a#########

psam <- read.csv("D:/Downloads/psam_p34.csv", stringsAsFactors=FALSE)
```

b. Add a new column to the data frame and fill it with 10 in all rows.

```
#######Q2b#########

psam$newcol = 10

colnames(psam)

psam['newcol']
```

c. Add a new column to the data frame and copy the data from an existing column in the dataset, `PWGTP80` into this column.

```
#######Q2c#########

psam$newcol = psam$PWGTP80

psam['newcol']
```

d. Delete the column `PWGTP74`

```
#######Q2d#########

psam$PWGTP74 <- NULL

#colnames(psam)
```

e. Rename the column `CIT` as `CHARCT`

```
#######Q2e#########


names(psam)[names(psam) == 'CIT'] <- 'CHARCT'

#colnames(psam)
```

```
psam["CHARCT"]
```

Question 3: Subsetting & Sorting Data

Subsetting data is the process of retrieving just the parts of larger datasets that are of specific interest for the project at hand. It is a very important component of data management and there are several ways that one can subset data in R.

a. Complete the data subsetting tutorial at this website

b. Sort the data according to the variable `MAR` in ascending order

```
#######Q3b########

head(psam)

psam1 = psam[order(psam$MAR),]

head(psam1)
```

c. Sort the data in ascending order by `PWGTP3` and descending order by `PWGTP7` together.

```
#######Q3c########


psam2 = psam[order(psam$PWGTP3, -psam$PWGTP7),]

head(psam2)
```

d. Create a subset of the data by â keepingâ the first 10 variables in the PUMS dataset (`RT` to `AGEP`) or â droppingâ the other variables.

```
#######Q3d########


psam_subset = psam[,1:10]

head(psam_subset)

dim(psam_subset)
```

e. Create a subset of the data by â keepingâ the first 10 observations.

```
#######Q3e#########

psam_sub = psam[1:10,]

head(psam_sub)
dim(psam_sub)
```

f. Take a random sample of the dataset of size 50:

   - with replacement

```
#######Q3f#########

#(i) with replacement
set.seed(100)
sam_rep = psam[sample(nrow(psam),50, replace = TRUE),]

head(sam_rep)

* without replacement

#(ii) without replacement
sam_wrep = psam[sample(nrow(psam),50, replace = FALSE),]

head(sam_wrep)
```

Question 4: Descriptive Stats

For this question, we will use one of the most common R built-in datasets, `mtcars`. The easiest way to get descriptive statistics in R is using the `summary()` command.

a. Find the summary statistics of the `mtcars` dataset using the `summary()` command.

```
#######Q4a#########

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  
```

b. Another way to get more detailed descriptive statistics is to use the pastecs package.

- Install the pastecs package:
    - Type install.packages("pastecs") and load it from the library by typing library(pastecs)

```
#######Q4b########

#install.packages("pastecs")
library(pastecs)

## Warning: package 'pastecs' was built under R version 3.5.2

* Find the command to get the descriptive statistics using this package.
(Hint: your output should give you a minimum, maximum, range, SE. mean, C.I
Mean, standard deviation and coefficient of variance etc)

stat.desc(mtcars)

##                       mpg         cyl         disp           hp
## nbr.val       32.0000000  32.0000000 3.200000e+01   32.0000000
## nbr.null       0.0000000   0.0000000 0.000000e+00    0.0000000
## nbr.na         0.0000000   0.0000000 0.000000e+00    0.0000000
## min           10.4000000   4.0000000 7.110000e+01   52.0000000
## max           33.9000000   8.0000000 4.720000e+02  335.0000000
## range         23.5000000   4.0000000 4.009000e+02  283.0000000
## sum          642.9000000 198.0000000 7.383100e+03 4694.0000000
## median        19.2000000   6.0000000 1.963000e+02  123.0000000
## mean          20.0906250   6.1875000 2.307219e+02  146.6875000
## SE.mean        1.0654240   0.3157093 2.190947e+01   12.1203173
## CI.mean.0.95   2.1729465   0.6438934 4.468466e+01   24.7195501
## var           36.3241028   3.1895161 1.536080e+04 4700.8669355
## std.dev        6.0269481   1.7859216 1.239387e+02   68.5628685
## coef.var       0.2999881   0.2886338 5.371779e-01    0.4674077
##                       drat          wt        qsec          vs          am
## nbr.val       32.00000000  32.0000000  32.0000000 32.00000000 32.00000000
## nbr.null       0.00000000   0.0000000   0.0000000 18.00000000 19.00000000
## nbr.na         0.00000000   0.0000000   0.0000000  0.00000000  0.00000000
## min              2.76000000   1.5130000  14.5000000  0.00000000  0.00000000
## max              4.93000000   5.4240000  22.9000000  1.00000000  1.00000000
## range            2.17000000   3.9110000   8.4000000  1.00000000  1.00000000
## sum            115.09000000 102.9520000 571.1600000 14.00000000 13.00000000
## median           3.69500000   3.3250000  17.7100000  0.00000000  0.00000000
## mean             3.59656250   3.2172500  17.8487500  0.43750000  0.40625000
## SE.mean          0.09451874   0.1729685   0.3158899  0.08909831  0.08820997
## CI.mean.0.95     0.19277224   0.3527715   0.6442617  0.18171719  0.17990541
## var              0.28588135   0.9573790   3.1931661  0.25403226  0.24899194
## std.dev          0.53467874   0.9784574   1.7869432  0.50401613  0.49899092
## coef.var         0.14866382   0.3041285   0.1001159  1.15203687  1.22828533
##                     gear       carb
## nbr.val       32.0000000 32.0000000
## nbr.null       0.0000000  0.0000000
## nbr.na         0.0000000  0.0000000
## min            3.0000000  1.0000000
## max            5.0000000  8.0000000
## range          2.0000000  7.0000000
## sum          118.0000000 90.0000000
## median         4.0000000  2.0000000
## mean           3.6875000  2.8125000
## SE.mean        0.1304266  0.2855297
## CI.mean.0.95   0.2660067  0.5823417
## var            0.5443548  2.6088710
## std.dev        0.7378041  1.6152000
## coef.var       0.2000825  0.5742933
```

c. There are also separate commands to get the mean, median and mean statistics. Find the mean, median and mode of the variable `mpg` by separate commands.

```
#######Q4c#########

mean(mtcars$mpg)

## [1] 20.09062

median(mtcars$mpg)

## [1] 19.2

mode1 = names(table(mtcars$mpg))[table(mtcars$mpg)==max(table(mtcars$mpg))]

mode1

## [1] "10.4" "15.2" "19.2" "21"   "21.4" "22.8" "30.4"
```

d. Find the length of the variable `qtsec`. Why are the lengths of all the variables the same?

```
#######Q4d#########

length(mtcars$qsec)

## [1] 32

# Length of 'qsec' is 32
# Variables are part of dataframe , which is a table and each varaible needs
to be equal lentyh to form a tabular structure. even if variables are of
uneqaul lenth they are filled with NULL to make up the dimensions of table.
```

e. Find the maximum and minimum value of the `mpg` variable.

```
#######Q4e#########

mpg_max = max(mtcars$mpg)
mpg_max

## [1] 33.9

mpg_min= min(mtcars$mpg)
mpg_min

## [1] 10.4
```

f. Determine the location i.e index of the maximum and minimum value you found in part e. (Hint: Try the `which.max` command).

```
#######Q4f#########

which.max(mtcars$mpg)

## [1] 20

which.min(mtcars$mpg)

## [1] 15
```

Question 5: Putting it all together

Downloading a dataset:

1. Go to this link on Kaggle. This should take you to a page for the “San Francisco Building Permits” dataset. (**note**: you will have to create an account in roder to download this dataset. Kaggle is a PHENOMENAL resource for datasets and data-related explorations, so making this account now will help you for future assignments.)

2. Once youâ ve downloaded this dataset, time to **import** the dataset into RStudio (Refer to Question 2 for tips on importing datasets). Type in the code that imports this dataset below: (After a while, you will see that the dataset â `Building_Permitsâ` is available in your â Global Variableâ explorer in RStudio)

```
#######Q5->2########

Building_Permits <- read.csv("C:/Users/akhil/Downloads/Building_Permits.csv",
stringsAsFactors=FALSE)
```

Preparing for data manipulation:

1. If youâ ve successfully imported the dataset, you should have a `Building_Permits` variable in your global explorer – **congrats!** As per convention, itâ s always a great idea to create a **copy** of your dataset, so that whatever manipulations you make donâ t affect the original dataset. With that being said, make a copy of the dataset! * **hint:** Name the copy whatever you would like and literally use the `<-` operator to assign your newly named variable to the existing `Building_Permits` dataset

```
#######Q5->2->1########

buldgp = Building_Permits
```

Exploring the dataset:

1. Thus far, weâ ve downloaded the dataset and made copies to prevent against any future accidents. Now, letâ s explore our dataset a little further and really understand what weâ re dealing with here:

2. Reproduce the following printed statement **with code** and **replace X** with the number of rows and **replace Y** with the number of columns of your dataset : `Dimensions:  X rows,  Y columns`

- **hints**:
    1. you'll find the R cat() function really helpful
    2. The `dim()` function from question 1 will be really useful! (Also, there are two components that are returned by calling the `dim()` function, and you can access each portion with a proper index call (example: `dim(â <dataset_nameâ >)[index]`)
    3. You can use the cat() function as follows: `cat(â <String: â , data, â <another string>â , more data)`

```
#######Q5->3->2########

dim(buldgp)

cat("Dimensions: ",dim(buldgp)[1], " rows, ",dim(buldgp)[2], " columns"  )
```

3. Generally, if weâ re dealing with data that is numeric, it might be helpful to look for the averages in a dataset. Take a quick look at the different columns of this dataset – do you think itâ s appropriate to analyze stats like the mean, median, mode for the numeric columns? Why or why not?

```
#######Q5->3->3########
str(buldgp)

## 'data.frame':    198900 obs. of  43 variables:
##  $ Permit.Number                          : chr  "201505065519"
"201604195146" "201605278609" "201611072166" ...
##  $ Permit.Type                            : int  4 4 3 8 6 8 8 8 8 8 ...
##  $ Permit.Type.Definition                 : chr  "sign - erect" "sign -
erect" "additions alterations or repairs" "otc alterations permit" ...
##  $ Permit.Creation.Date                   : chr  "05/06/2015" "04/19/2016"
"05/27/2016" "11/07/2016" ...
##  $ Block                                  : chr  "0326" "0306" "0595"
"0156" ...
##  $ Lot                                    : chr  "023" "007" "203" "011"
...
##  $ Street.Number                          : int  140 440 1647 1230 950 800
1291 1465 2094 89 ...
##  $ Street.Number.Suffix                   : chr  "" "" "" "" ...
##  $ Street.Name                            : chr  "Ellis" "Geary" "Pacific"
"Pacific" ...
##  $ Street.Suffix                          : chr  "St" "St" "Av" "Av" ...
##  $ Unit                                   : int  NA 0 NA 0 NA NA 0 NA NA NA
...
##  $ Unit.Suffix                            : chr  "" "" "" "" ...
##  $ Description                            : chr  "ground fl facade: to
erect illuminated, electric, wall, single faced sign. n/a for maher ordinance
155-13." "remove (e) awning and associated signs." "installation of
separating wall" "repair dryrot & stucco at front of bldg." ...
##  $ Current.Status                         : chr  "expired" "issued"
"withdrawn" "complete" ...
##  $ Current.Status.Date                    : chr  "12/21/2017" "08/03/2017"
"09/26/2017" "07/24/2017" ...
##  $ Filed.Date                             : chr  "05/06/2015" "04/19/2016"
"05/27/2016" "11/07/2016" ...
##  $ Issued.Date                            : chr  "11/09/2015" "08/03/2017"
"" "07/18/2017" ...
##  $ Completed.Date                         : chr  "" "" "" "07/24/2017" ...
##  $ First.Construction.Document.Date       : chr  "11/09/2015" "08/03/2017"
"" "07/18/2017" ...
##  $ Structural.Notification                : chr  "" "" "" "" ...
##  $ Number.of.Existing.Stories             : num  6 7 6 2 3 5 3 NA NA NA ...
##  $ Number.of.Proposed.Stories             : num  NA NA 6 2 NA 5 3 NA NA NA
...
##  $ Voluntary.Soft.Story.Retrofit          : chr  "" "" "" "" ...
##  $ Fire.Only.Permit                       : chr  "" "" "" "" ...
##  $ Permit.Expiration.Date                 : chr  "11/03/2016" "12/03/2017"
```

```
"" "07/13/2018" ...
##  $ Estimated.Cost                        : num  4000 1 20000 2000 100000
4000 12000 NA NA NA ...
##  $ Revised.Cost                          : num  4000 500 NA 2000 100000
4000 12000 0 1 0 ...
##  $ Existing.Use                          : chr  "tourist hotel/motel"
"tourist hotel/motel" "retail sales" "1 family dwelling" ...
##  $ Existing.Units                        : num  143 NA 39 1 NA 326 5 NA NA
NA ...
##  $ Proposed.Use                          : chr  "" "" "retail sales" "1
family dwelling" ...
##  $ Proposed.Units                        : int  NA NA 39 1 NA 326 5 NA NA
NA ...
##  $ Plansets                              : int  2 2 2 2 2 2 0 NA NA NA ...
##  $ TIDF.Compliance                       : chr  "" "" "" "" ...
##  $ Existing.Construction.Type            : int  3 3 1 5 3 1 5 NA NA NA ...
##  $ Existing.Construction.Type.Description: chr  "constr type 3" "constr
type 3" "constr type 1" "wood frame (5)" ...
##  $ Proposed.Construction.Type            : int  NA NA 1 5 NA 1 5 NA NA NA
...
##  $ Proposed.Construction.Type.Description: chr  "" "" "constr type 1"
"wood frame (5)" ...
##  $ Site.Permit                           : chr  "" "" "" "" ...
##  $ Supervisor.District                   : int  3 3 3 3 6 10 5 10 5 8 ...
##  $ Neighborhoods...Analysis.Boundaries   : chr  "Tenderloin" "Tenderloin"
"Russian Hill" "Nob Hill" ...
##  $ Zipcode                               : int  94102 94102 94109 94109
94102 94107 94122 94124 94117 94117 ...
##  $ Location                              : chr  "(37.785719256680785, -
122.40852313194863)" "(37.78733980600732, -122.41063199757738)"
"(37.7946573324287, -122.42232562979227)" "(37.79595867909168, -
122.41557405519474)" ...
##  $ Record.ID                             : num  1.38e+12 1.42e+12 1.42e+12
1.44e+12 1.45e+11 ...
```

```
summary(buldgp)
```

```
##  Permit.Number       Permit.Type    Permit.Type.Definition
##  Length:198900      Min.   :1.000   Length:198900         
##  Class :character   1st Qu.:8.000   Class :character      
##  Mode  :character   Median :8.000   Mode  :character      
##                     Mean   :7.522                         
##                     3rd Qu.:8.000                         
##                     Max.   :8.000                         
##                                                           
##  Permit.Creation.Date    Block               Lot            Street.Number
##  Length:198900        Length:198900      Length:198900      Min.   :   0
##  Class :character     Class :character   Class :character   1st Qu.: 235
##  Mode  :character     Mode  :character   Mode  :character   Median : 710
##                                                             Mean   :1122
##                                                              3rd Qu.:1700
##                                                              Max.   :8400
##
##  Street.Number.Suffix Street.Name        Street.Suffix
##  Length:198900        Length:198900      Length:198900
##  Class :character     Class :character   Class :character
##  Mode  :character     Mode  :character   Mode  :character
##
##
##
##
##       Unit         Unit.Suffix        Description
##  Min.   :   0.00   Length:198900      Length:198900
##  1st Qu.:   0.00   Class :character   Class :character
##  Median :   0.00   Mode  :character   Mode  :character
##  Mean   :  78.52
##  3rd Qu.:   1.00
##  Max.   :6004.00
##  NA's   :169421
##  Current.Status     Current.Status.Date  Filed.Date
##  Length:198900      Length:198900       Length:198900
##  Class :character   Class :character    Class :character
##  Mode  :character   Mode  :character    Mode  :character
##
##
##
##
##  Issued.Date        Completed.Date     First.Construction.Document.Date
##  Length:198900      Length:198900      Length:198900
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  Structural.Notification Number.of.Existing.Stories
##  Length:198900           Min.   : 0.00
##  Class :character        1st Qu.: 2.00
##  Mode  :character        Median : 3.00
##                          Mean   : 5.71
##                          3rd Qu.: 4.00
##                          Max.   :78.00
##                          NA's   :42784
##  Number.of.Proposed.Stories Voluntary.Soft.Story.Retrofit
##  Min.   : 0.00              Length:198900
##  1st Qu.: 2.00              Class :character
##  Median : 3.00              Mode  :character
##  Mean   : 5.75
##  3rd Qu.: 4.00
##  Max.   :78.00
##  NA's   :42868
##  Fire.Only.Permit   Permit.Expiration.Date Estimated.Cost
##  Length:198900      Length:198900          Min.   :1.00e+00
##  Class :character   Class :character       1st Qu.:3.30e+03
##  Mode  :character   Mode  :character       Median :1.10e+04
##                                            Mean   :1.69e+05
##                                            3rd Qu.:3.50e+04
##                                            Max.   :5.38e+08
##                                            NA's   :38066
##   Revised.Cost       Existing.Use       Existing.Units
##  Min.   :        0   Length:198900      Min.   :   0.00
##  1st Qu.:        1   Class :character   1st Qu.:   1.00
##  Median :     7000   Mode  :character   Median :   1.00
##  Mean   :   132856                      Mean   :  15.67
##  3rd Qu.:    28708                      3rd Qu.:   4.00
##  Max.   :780500000                      Max.   :1907.00
##  NA's   :6066                           NA's   :51538
##  Proposed.Use       Proposed.Units       Plansets       TIDF.Compliance
##  Length:198900      Min.   :   0.00   Min.   :   0.00   Length:198900
##  Class :character   1st Qu.:   1.00   1st Qu.:   0.00   Class :character
##  Mode  :character   Median :   2.00   Median :   2.00   Mode  :character
##                     Mean   :  16.51   Mean   :   1.27
##                     3rd Qu.:   4.00   3rd Qu.:   2.00
##                     Max.   :1911.00   Max.   :9000.00
##                     NA's   :50911     NA's   :37309
##  Existing.Construction.Type Existing.Construction.Type.Description
##  Min.   :1.00               Length:198900
##  1st Qu.:3.00               Class :character
##  Median :5.00               Mode  :character
##  Mean   :4.07
##  3rd Qu.:5.00
##  Max.   :5.00
##  NA's   :43366
##  Proposed.Construction.Type Proposed.Construction.Type.Description
##  Min.   :1.00               Length:198900
##  1st Qu.:3.00               Class :character
##  Median :5.00               Mode  :character
##  Mean   :4.09
##  3rd Qu.:5.00
##  Max.   :5.00
##  NA's   :43162
##  Site.Permit        Supervisor.District
##  Length:198900      Min.   : 1.000
##  Class :character   1st Qu.: 3.000
##  Mode  :character   Median : 6.000
##                     Mean   : 5.538
##                     3rd Qu.: 8.000
##                     Max.   :11.000
##                     NA's   :1717
##  Neighborhoods...Analysis.Boundaries    Zipcode        Location
##  Length:198900                       Min.   :94102   Length:198900
##  Class :character                    1st Qu.:94109   Class :character
##  Mode  :character                    Median :94114   Mode  :character
##                                      Mean   :94116
##                                      3rd Qu.:94122
##                                      Max.   :94158
##                                      NA's   :1716
##    Record.ID
##  Min.   :1.294e+10
##  1st Qu.:1.309e+12
##  Median :1.372e+12
##  Mean   :1.162e+12
##  3rd Qu.:1.435e+12
##  Max.   :1.498e+12
##

# No, Because by running the above commands we can see that most of the
columns in the dataset are character strings.
# but there are some columns like units , Estimated cost , revised cost ,
etc. for which we can have need for mean , median.
```

4. We know that weâ re dealing with an incredible number of rows in our dataset (if you discovered the dimensions properly, weâ re looking at ~200k rows). However, for some columns, we donâ t have ~200k unique values. Letâ s discover some unique values. Find the number of unique values that are in the `Existing.Use` and the `Neighborhoods...Analysis.Boundaries` columns and print your results in the following format, replacing X and Y with their appropriate values (Please donâ t just *write* in the numbers, we want to see you **use** the functions in R to figure this out!) `The Existing.Use column has X unique values and the Neighborhoods...Analysis.Boundaries has Y unique values`

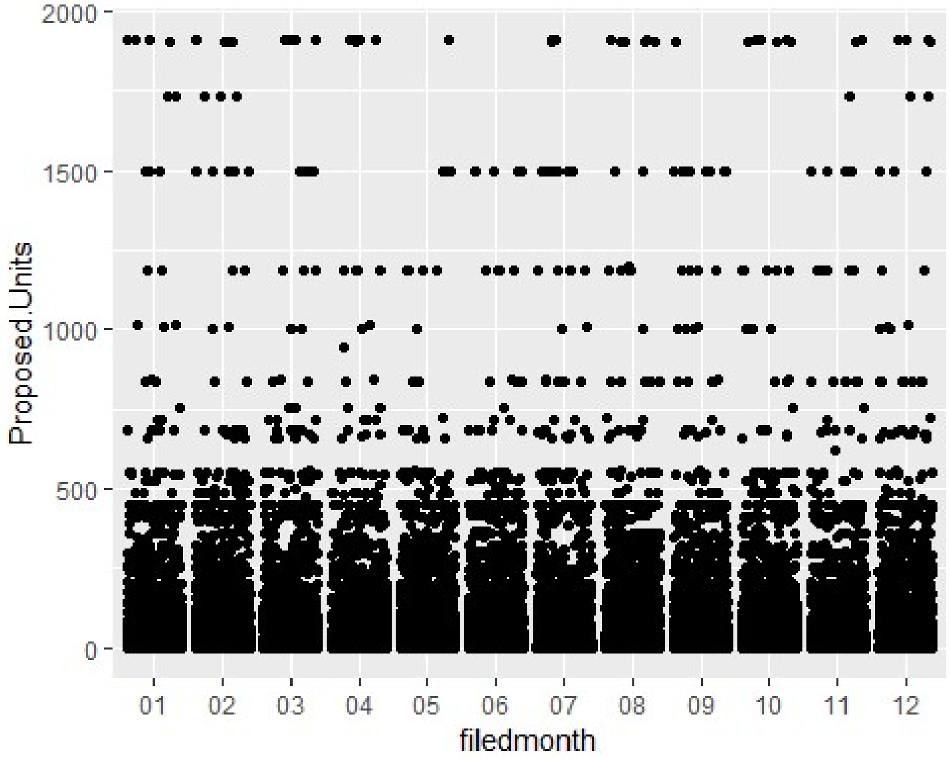
- **hints:**
    1. `cat()` will be your best friend!
    2. There is literally a function called unique()– figure out how to manipulate this!

```
#######Q5->3->4#########
#colnames(buldgp)

cat("The Existing.Use column has ", length(unique(buldgp$Existing.Use)),"
unique values and the Neighborhoods...Analysis.Boundaries has
",length(unique(buldgp$Neighborhoods...Analysis.Boundaries)) ," unique
values")
```

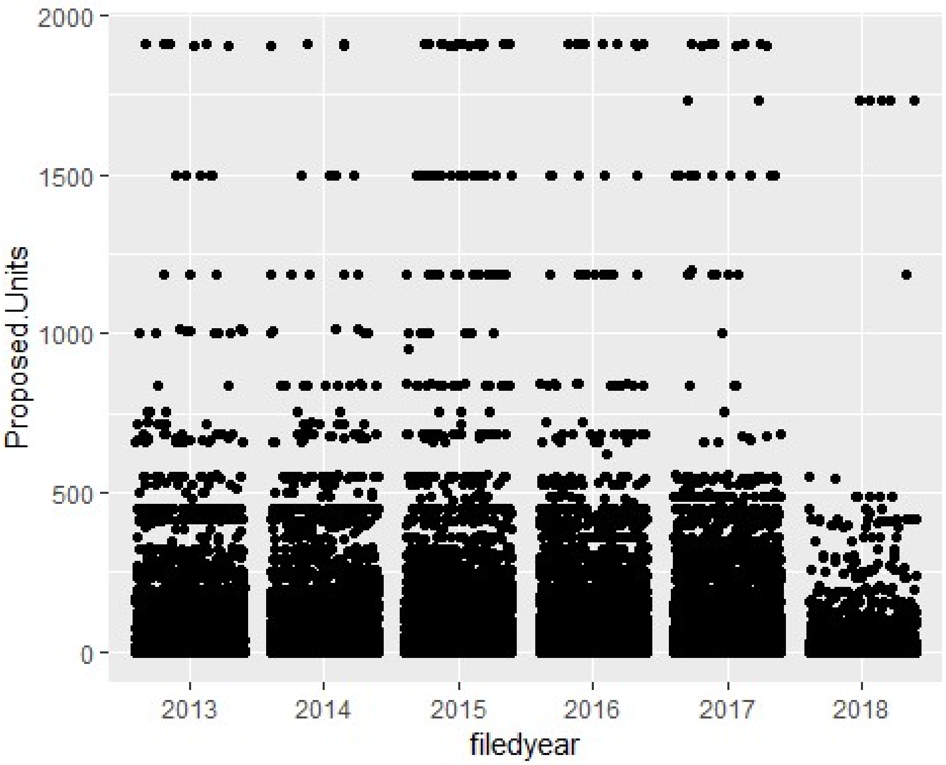
5. This is the DIY part of your data exploration – find something interesting about the data using R code, and tell us why you think itâ s interesting!

```
colnames(buldgp)
library(ggplot2)

# making a copy of dataset to perent changes.
temp = buldgp
```

```
str(temp)

#parsing the FiledDate column to recognize as Date in R
buldgp$Filed.Date <- as.Date(buldgp$Filed.Date, "%m/%d/%Y")

#creating new column with filedmonth
temp$filedmonth = format(buldgp$Filed.Date,'%m')

#creating new column with filedyear
temp$filedyear = format(buldgp$Filed.Date,'%Y')

# plotting filedmonth with the proposed.Units
ggplot(temp,aes(x=filedmonth , y = Proposed.Units)) +
  geom_jitter()

## Warning: Removed 50911 rows containing missing values (geom_point).
```

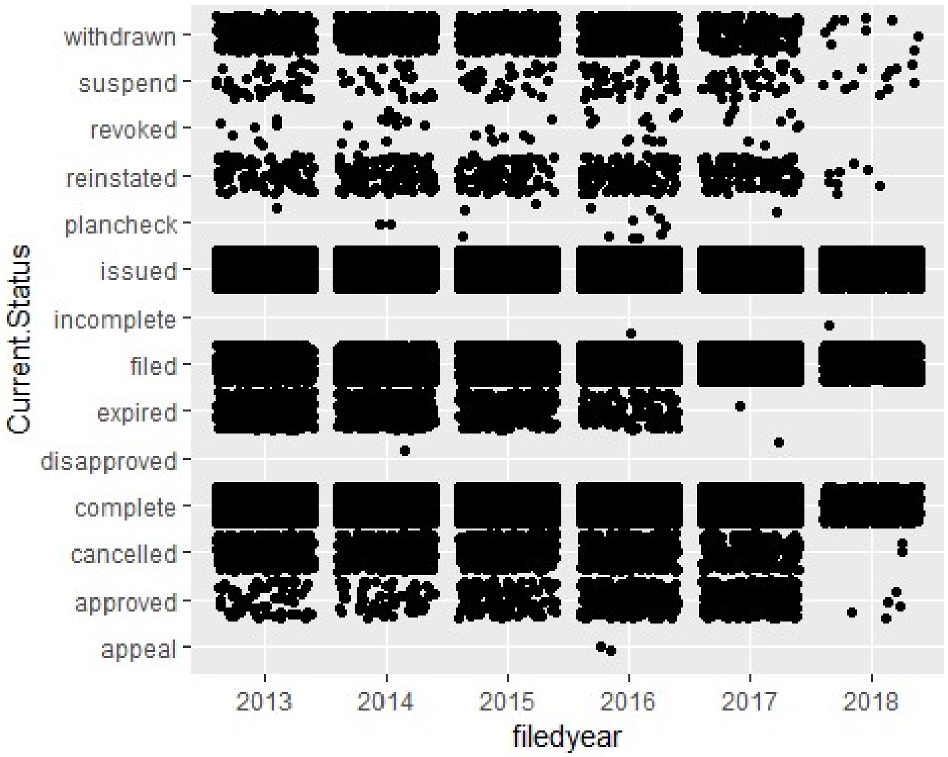


```
# plotting filedmonth with the proposed.Units
ggplot(temp,aes(x=filedyear , y = Proposed.Units)) +
  geom_jitter()

## Warning: Removed 50911 rows containing missing values (geom_point).
```

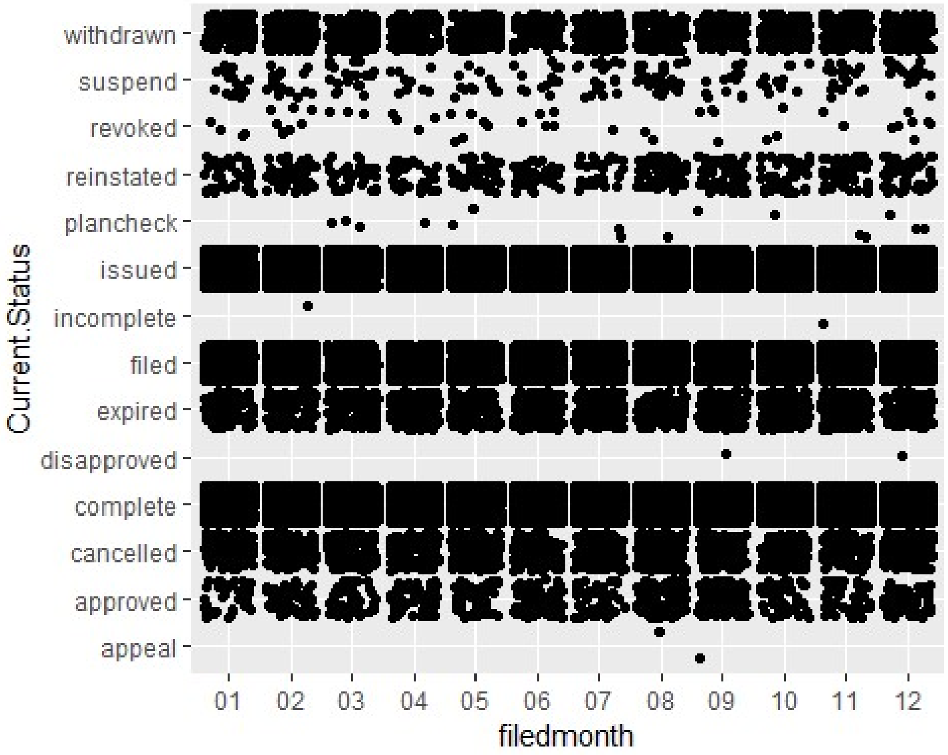


From the above graph we can conclude that most of the proposed units where in the months of January & May and the higgest number of proposed units is 1500 in months of january. Also, Looking at the year graph we can say that most of the units where proposed in 2013 and some of units where proposed in 2017.

```
temp$Current.Status = as.factor( temp$Current.Status)

ggplot(temp,aes(x=filedyear , y = Current.Status)) +
  geom_jitter()
```



```r
ggplot(temp,aes(x=filedmonth , y = Current.Status)) +
  geom_jitter()
```



From the above graph we can conclude that Current status of most of the Bulding permits were in 2013 Also in 2013, the Current Status of permits where mostly issued, filed, complete & somewat withdrawm. Some of the permits where issued in 2017. From the other graph current status of projects are mostly concentrated in first 5 months and then permits are took down in rest of the year. Most of the permits appears to the issued & completed till the month of May.

Data Manipulation

*Letâ s draw upon Question 3: Subsetting datasets. Oftentimes, when weâ re working with data, weâ re not concerned about every single column in a dataset. Instead, there is only a handful of columns that are important to our needs. With this in mind, weâ ll subset our dataset so that we donâ t have to continually sift through relatively useless information in order to use our data. To this effect, weâ re going to create 2 individual â datasetsâ that are simply subsets of our main, overarching dataset.*s

a. Create a subset of your **copy** of the `Building_Permits` dataset that only contains the following columns: `Permit.Number`, `Description`, `Existing.Use`

```
#######Q5->4->1a#########

#colnames(buldgp)

#buldgp_sub =
cbind(buldgp$Existing.Use,buldgp$Permit.Number,buldgp$Description)

buldg_sub1 = buldgp[c("Existing.Use","Description","Permit.Number")]

dim(buldg_sub1)
```

b. Create a second subset of your **copy** of the `Building_Permits` dataset that only contains the following columns: `Permit.Number`, `Proposed.Use`. However, we want this subset to only access entries from row 50,000 to 60,000.
   - **hints:**
   - when subsetting for specific entries in a dataset, we can actually do the following: `dataset[index, index][<condition>]`
   - To access rows in a column, we specify the index to be `dataset[index,]`. The lefthand side is for specifying rows, the righthand side is for specifying columns

```
#######Q5->4->b#########
buldg_sub2 = buldgp[50000:60000, c("Permit.Number","Proposed.Use")]
```

c. Now that we have two separate components of our dataset, letâ s merge them together! Realistically, youâ d really just create a singular subset with this information together. However, we have a highly specific use case now: one of our subsets only refers to a portion of the entries in our dataset, while the other dataset refers to all of the entries in our dataset 1. Merging datasets requires a really, really longwinded and misleading complex function: merge() (this was a miserable joke by one of your TAs, feel free to send hate mail to Sridhar). Read the documentation, understand the parameters, and merge the datasets based on the `Permit.Number` column into a new variable.

```
#######Q5->4->c#########

buldg_sub = merge(buldg_sub1,buldg_sub2,by="Permit.Number")

head(buldg_sub,10)

dim(buldg_sub)
```

d. Thereâ s now an interesting phenomenon regarding our dataset: even though the second subset dealt with rows 50,000 to 60,000 (~ 10k entries), our new dataset does not match the ~10k dimension! Why do you think this is? (**hint**: `unique()` might come in handy)

```
#######Q5->4->d#########

length(unique(buldg_sub$Permit.Number))

## [1] 9221

#By default the data frames are merged on the columns with names they both
have, but separate specifcations of the columns can be given by by.x and
by.y. Columns can be specified by name, number or by a logical vector: the
name "row.names" or the number 0 specifies the row names. The rows in the two
data frames that match on the specified columns are extracted, and joined
together. If there is more than one match, all possible matches contribute
one row each.

#So, in our case the 10,000 values of second dataframe matched with the ~200k
values in 1st data frame and if there where more than one match it lead to
their individul columns. which lead to a total of 11783 values means we have
unique values as 9221 , so 2562 are the duplicates that matched more than one
pair.
```

e. Letâ s take this newly merged dataset, and alphabetize the data based on the `Proposed.Use` column. The order() function will help tremendously!

```
#######Q5->4->e#########

buldgp = buldgp[order(buldg_sub$Proposed.Use),]

head(buldgp)
```

f. Take a look at your new, alphabetized dataset. In the `Proposed.Use` column, weâ re missing data for what seems to be a decent amount of columnâ s entries. Normally, weâ d use the `is.na()` or `is.null()` function like we did earlier to check for missing data. However, in this dataset, all empty data are actually considered to be *empty strings*. (Example: â â). It sounds really counterintuitive but despite these entries being visibly empty, R considers them to be non-empty entries. With this in mind, letâ s tackle the missing data:

   1. Find the number of missing data points in the `Proposed.Use` column. (Youâ ll need to check which entries are **empty strings**)

```
#######Q5->4->f#########

sum(buldg_sub$Proposed.Use == "")

which(buldg_sub$Proposed.Use == "")
```

g. Through a stroke of luck, Dr. Felder recently stumbled on a bit of cash and has decided to quit his job as a professor and invest in real estate full time! (again, a miserable joke). To help him with this, we want to replace all of the missing entries that we found in the `Proposed.Use` column with â `felderâ s penthouseâ`

   - **warning:** this is not an easy task and requires a bit of thinking. This post on StackOverflow is really insightful to approach this problem.
     - This post converts the existing column to a character datatype with `as.character()` because even though that we can see that the entries in a column are text, R sometimes encodes text-based columns as different data types. To guard against this, we use `as.character()`.
   - **side note**: side note (optional): sometimes, we want to export datasets that we create so that others can use them! write.csv() is a really helpful way to write any dataframes to .csv files!

```
#######Q5->4->g#########


buldg_sub$Proposed.Use[buldg_sub$Proposed.Use == ""] <- "felder's penthouse"

sum(buldg_sub$Proposed.Use == "felder's penthouse")
```

Feedback

a. How long did it take to complete this homework? -> Almost 2 days

b. How difficult was the homework? -> 6 (on scale of 1-10) it was not difficult just the thing is it had many questions. So, it took time .

c. Which parts did you find useful and which parts were less useful? -> Q5 was challenging and whole assignment is usefull.

d. What suggestions do you have regarding the lectures or homework assignments that would improve them? -> instead of putting questions in Rmd file you can just put chunks and write their respesctive question numbers so that it becomes easy to navigate and code looks much clean. whereas in this current scenario it becomes too crowded and much harder to navigate to any sub question. just put the questions in assignmnet pdf we can reffer question from their. example :

```
####### this is an example for Question number#####
# this above line  helps to navigate to respective chunks.
```