Midterm Project for Data Science in R

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County-level oil and gas production

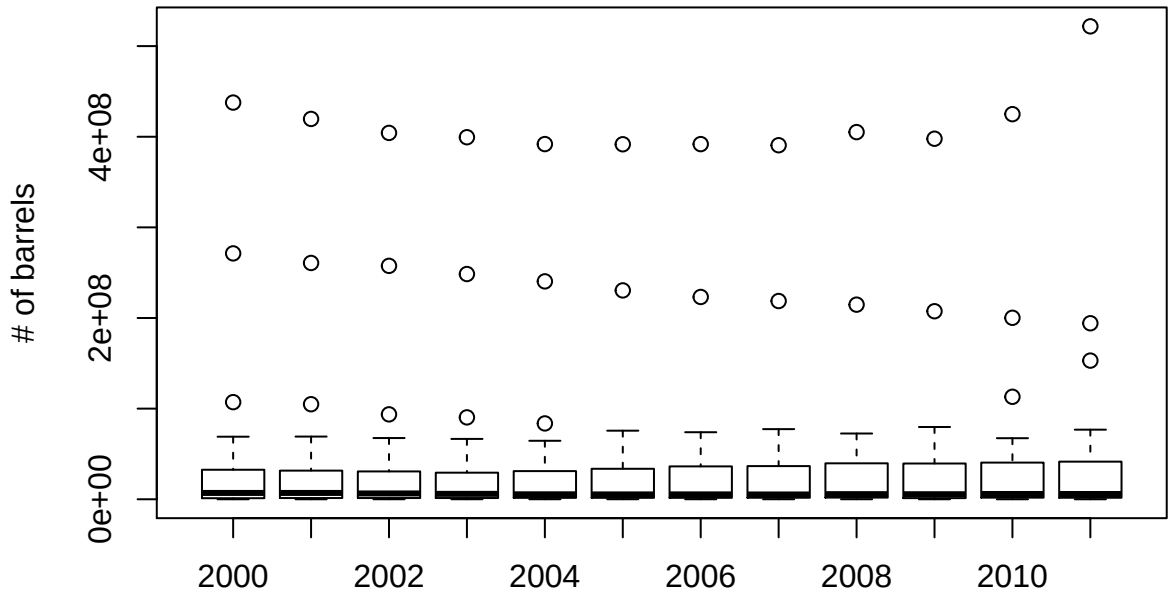
```
# load in the data via the Import Dataset feature in the workspace
df <- read.csv(file = "~/Documents/HW/MA615/Assignments/MidtermProject/oilgascounty.csv")
set.seed(100)
# remove columns that are not useful
df <- df[, -c(1, 2, 5, 6, 7, 8, 33, 34, 35)]
# divide dataframe into two dataframes: one called df_oil and the other
# df_gas
df_oil <- df[c(1, 2, 3:14)]
df_gas <- df[c(1, 2, 15:26)]
# convert integer values to numeric
df_oil[, 3:14] <- sapply(df_oil[, 3:14], as.numeric)
df_gas[, 3:14] <- sapply(df_gas[, 3:14], as.numeric)

# split the dataframe by states and store them as a list list_oil_by_state
# <- split(df_oil, df_oil$Stabr) list_gas_by_state <- split(df_gas,
# df_gas$Stabr)

# use aggregate to compute the sum for each state
oilsum <- aggregate(df_oil[, 3:14], list(State = df_oil$Stabr), sum)
gassum <- aggregate(df_gas[, 3:14], list(State = df_gas$Stabr), sum)

# Go through each row and determine if any state produced nothing over 12
# years
oilsum <- oilsum[apply(oilsum, 1, function(o) !(any(as.numeric(o[2:13]) == 0))),
    ]
gassum <- gassum[apply(gassum, 1, function(g) !(any(as.numeric(g[2:13]) == 0))),
    ]
# change column names for plotting later
oilsum <- setNames(oilsum, c("State", "2000", "2001", "2002", "2003", "2004",
    "2005", "2006", "2007", "2008", "2009", "2010", "2011"))
gassum <- setNames(gassum, c("State", "2000", "2001", "2002", "2003", "2004",
    "2005", "2006", "2007", "2008", "2009", "2010", "2011"))

# We are done clean and tidy the oil and gas data
saveRDS(oilsum, file = "oil.rda")
saveRDS(gassum, file = "gas.rda")
```

Plotting oil production

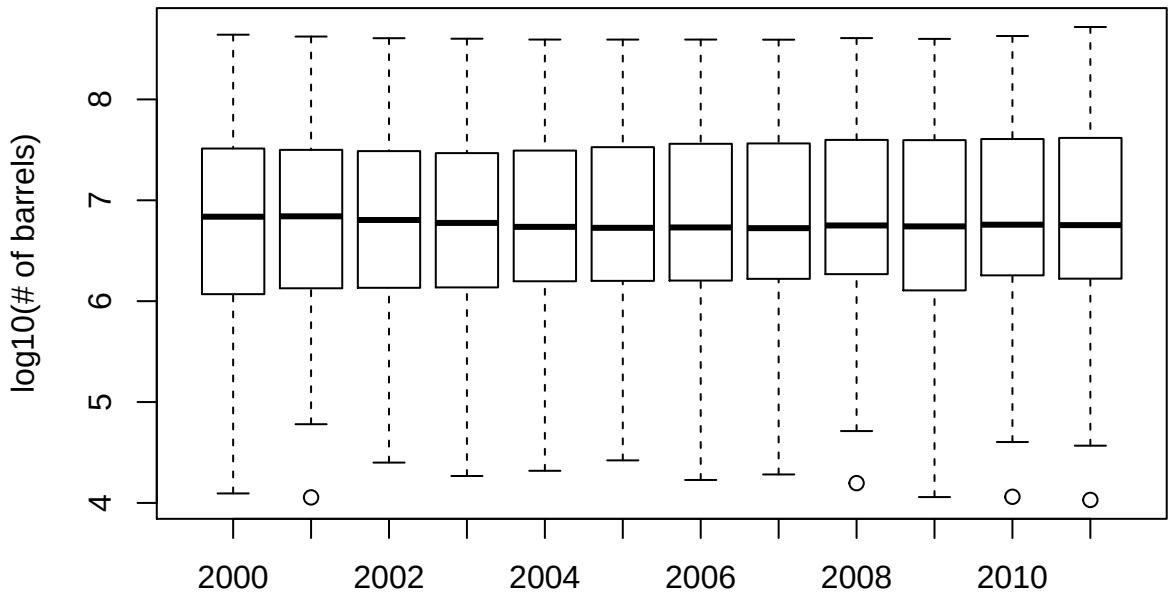
```
# output statistics of oil and gas production
summary(oilsum[2:13])
```

```
##       2000               2001               2002
##  Min.   :    12418   Min.   :    11344   Min.   :    25110
##  1st Qu.:  1224338   1st Qu.:  1376536   1st Qu.:  1428459
##  Median :  6971772   Median :  6970699   Median :  6423510
##  Mean   : 40408306   Mean   : 39151238   Mean   : 37732866
##  3rd Qu.: 29510202   3rd Qu.: 28774348   3rd Qu.: 28182201
##  Max.   :437700231   Max.   :419634532   Max.   :404223421
##       2003               2004               2005
##  Min.   :    18489   Min.   :    20816   Min.   :    26417
##  1st Qu.:  1437801   1st Qu.:  1611746   1st Qu.:  1589299
##  Median :  5982368   Median :  5469592   Median :  5344706
##  Mean   : 36976349   Mean   : 36311026   Mean   : 35946045
##  3rd Qu.: 27405895   3rd Qu.: 29493290   3rd Qu.: 33411226
##  Max.   :399461473   Max.   :391896994   Max.   :391691263
##       2006               2007               2008
##  Min.   :    16881   Min.   :    19155   Min.   :    15712
##  1st Qu.:  1628042   1st Qu.:  1677861   1st Qu.:  1883152
##  Median :  5392808   Median :  5302684   Median :  5659828
##  Mean   : 36160064   Mean   : 36378418   Mean   : 37576201
##  3rd Qu.: 36137736   3rd Qu.: 36169382   3rd Qu.: 37648659
##  Max.   :391870785   Max.   :390621796   Max.   :405114648
##       2009               2010               2011
##  Min.   :    11430   Min.   :    11508   Min.   :    10712
##  1st Qu.:  1374993   1st Qu.:  1809066   1st Qu.:  1734578
##  Median :  5550575   Median :  5822812   Median :  5796684
##  Mean   : 37390160   Mean   : 39294441   Mean   : 44857266
##  3rd Qu.: 37155044   3rd Qu.: 38538030   3rd Qu.: 40928700
##  Max.   :397818942   Max.   :424899287   Max.   :521790261
```

```r
# Normal boxplot
boxplot(oilsum[2:13], names = c("2000", "2001", "2002", "2003", "2004", "2005",
    "2006", "2007", "2008", "2009", "2010", "2011"), main = "Oil Production in US (48 states)",
    ylab = "# of barrels")
```




```
# since the top producing states, TX, ND, and AL have much larger values, we
# use log
log_oilsum <- log10(oilsum[2:13])
boxplot(log_oilsum[1:12], names = c("2000", "2001", "2002", "2003", "2004",
    "2005", "2006", "2007", "2008", "2009", "2010", "2011"), main = "Oil Production in US (48 states)",
    ylab = "log10(# of barrels)")
# a better visualization for log plot using ggplot/plotly
library(ggplot2)
```



```
library(plotly)
```

```
##
## Attaching package: 'plotly'
```

```
## The following object is masked from 'package:ggplot2':
##
##     last_plot
```

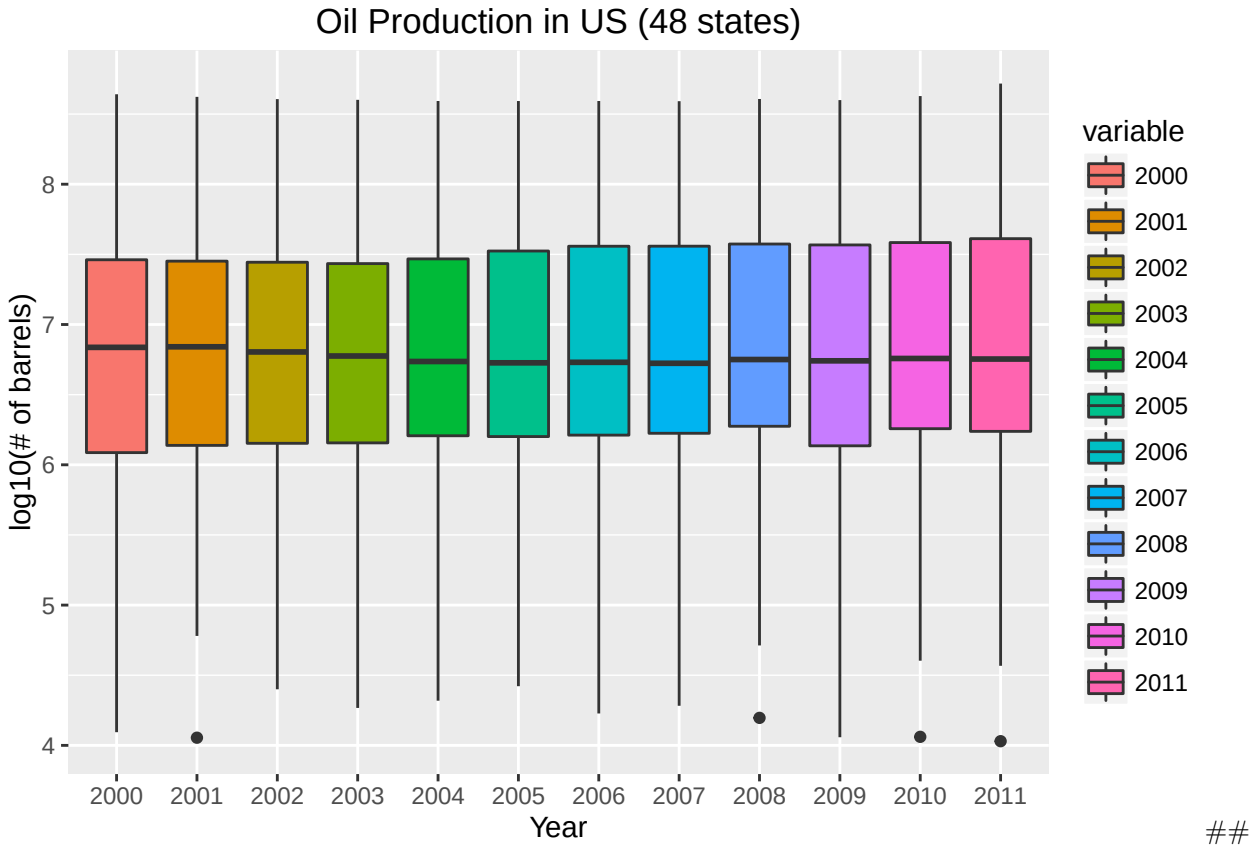
```
## The following object is masked from 'package:stats':
##
##     filter
```

```
## The following object is masked from 'package:graphics':
##
##     layout
```

```
# need reshape to further simply the two-way data
library("reshape2", lib.loc = "/Library/Frameworks/R.framework/Versions/3.3/Resources/library")
oilsum2 <- melt(log_oilsum)
```

```
## No id variables; using all as measure variables
```

```
# convert year into vector

ggplot(oilsum2, aes(x = variable, y = value)) + geom_boxplot(aes(fill = variable)) +
    xlab("Year") + ylab("log10(# of barrels)") + ggtitle("Oil Production in US (48 states)")
```



##

Plotting Gas production

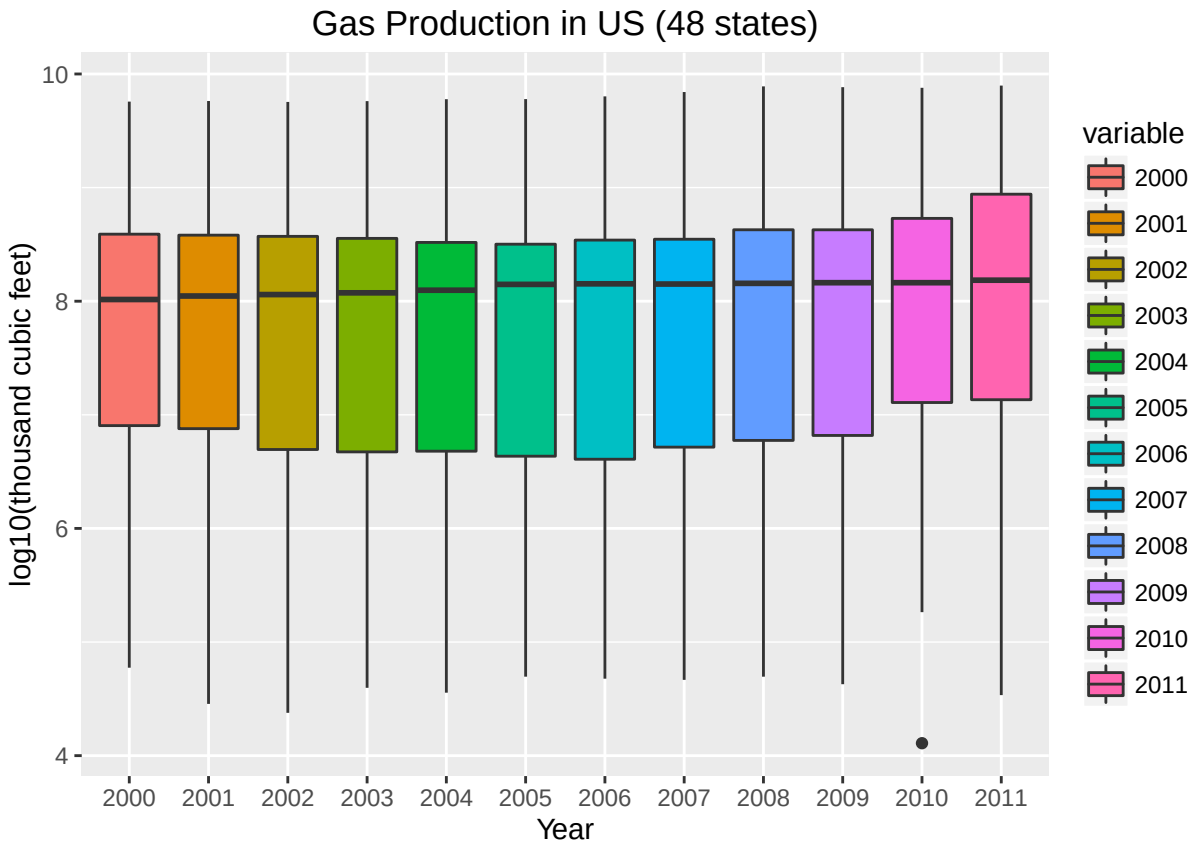
```
# output statistics of gas production
summary(gassum[2:13])
```

```
##       2000                2001                2002
##  Min.   :5.946e+04   Min.   :2.855e+04   Min.   :2.382e+04
##  1st Qu.:8.152e+06   1st Qu.:7.781e+06   1st Qu.:5.589e+06
##  Median :1.042e+08   Median :1.137e+08   Median :1.184e+08
##  Mean   :5.241e+08   Mean   :5.330e+08   Mean   :5.291e+08
##  3rd Qu.:3.899e+08   3rd Qu.:3.819e+08   3rd Qu.:3.730e+08
##  Max.   :5.713e+09   Max.   :5.780e+09   Max.   :5.677e+09
##       2003                2004                2005
##  Min.   :3.955e+04   Min.   :3.582e+04   Min.   :4.959e+04
##  1st Qu.:5.523e+06   1st Qu.:5.602e+06   1st Qu.:5.185e+06
##  Median :1.243e+08   Median :1.285e+08   Median :1.454e+08
##  Mean   :5.341e+08   Mean   :5.499e+08   Mean   :5.532e+08
##  3rd Qu.:3.582e+08   3rd Qu.:3.297e+08   3rd Qu.:3.176e+08
##  Max.   :5.770e+09   Max.   :5.998e+09   Max.   :6.009e+09
##       2006                2007                2008
##  Min.   :4.757e+04   Min.   :4.646e+04   Min.   :4.954e+04
##  1st Qu.:4.868e+06   1st Qu.:5.926e+06   1st Qu.:6.550e+06
##  Median :1.458e+08   Median :1.435e+08   Median :1.445e+08
##  Mean   :5.794e+08   Mean   :6.075e+08   Mean   :6.630e+08
##  3rd Qu.:3.456e+08   3rd Qu.:3.526e+08   3rd Qu.:4.264e+08
##  Max.   :6.350e+09   Max.   :6.938e+09   Max.   :7.778e+09
##       2009                2010                2011
##  Min.   :4.255e+04   Min.   :1.287e+04   Min.   :3.411e+04
##  1st Qu.:7.174e+06   1st Qu.:1.285e+07   1st Qu.:1.371e+07
##  Median :1.456e+08   Median :1.455e+08   Median :1.531e+08
##  Mean   :6.765e+08   Mean   :7.040e+08   Mean   :7.700e+08
##  3rd Qu.:4.270e+08   3rd Qu.:5.393e+08   3rd Qu.:9.274e+08
##  Max.   :7.654e+09   Max.   :7.559e+09   Max.   :7.906e+09
```

```
# plot using ggplot/plotly
gassum2 <- melt(log10(gassum[2:13]))
```

```
## No id variables; using all as measure variables
```

```
# convert year into vector
ggplot(gassum2, aes(x = variable, y = value)) + geom_boxplot(aes(fill = variable)) +
    xlab("Year") + ylab("log10(thousand cubic feet)") + ggtitle("Gas Production in US (48 states)")
```


Gas Production in US (48 states)
log10(thousand cubic feet)
10
8
6
4
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Year
variable
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011