Stat 450 Dates and Times

Prof. Eric A. Suess

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Chapter 16 Dates and Times

```r
library(tidyverse)
```

```
## -- Attaching packages ---------------------------------------------------------------------------------------
```

```
## v ggplot2 3.1.0     v purrr   0.2.5
## v tibble  1.4.2     v dplyr   0.7.7
## v tidyr   0.8.2     v stringr 1.3.1
## v readr   1.1.1     v forcats 0.3.0
```

```
## -- Conflicts ------------------------------------------------------------------------------------------------
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```r
library(lubridate)
```

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

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

```r
library(nycflights13)
```

```r
today()
```

```
## [1] "2018-12-03"
```

```r
now()
```

```
## [1] "2018-12-03 10:30:49 PST"
```

Dates from strings

```r
ymd("2017-01-31")
```

```
## [1] "2017-01-31"
```

```r
mdy("January 31st, 2017")
```

```
## [1] "2017-01-31"
```

```r
dmy("31-Jan-2017")
```

```
## [1] "2017-01-31"
```

Dates with times

```r
ymd_hms("2017-01-31 20:11:59")
```

```
## [1] "2017-01-31 20:11:59 UTC"
```

```r
mdy_hm("01/31/2017 08:01")
```

```
## [1] "2017-01-31 08:01:00 UTC"
```

```r
flights %>%
  select(year, month, day, hour, minute)
```

```
## # A tibble: 336,776 x 5
##     year month   day  hour minute
##    <int> <int> <int> <dbl>  <dbl>
##  1  2013     1     1     5     15
##  2  2013     1     1     5     29
##  3  2013     1     1     5     40
##  4  2013     1     1     5     45
##  5  2013     1     1     6      0
##  6  2013     1     1     5     58
##  7  2013     1     1     6      0
##  8  2013     1     1     6      0
##  9  2013     1     1     6      0
## 10  2013     1     1     6      0
## # ... with 336,766 more rows
```

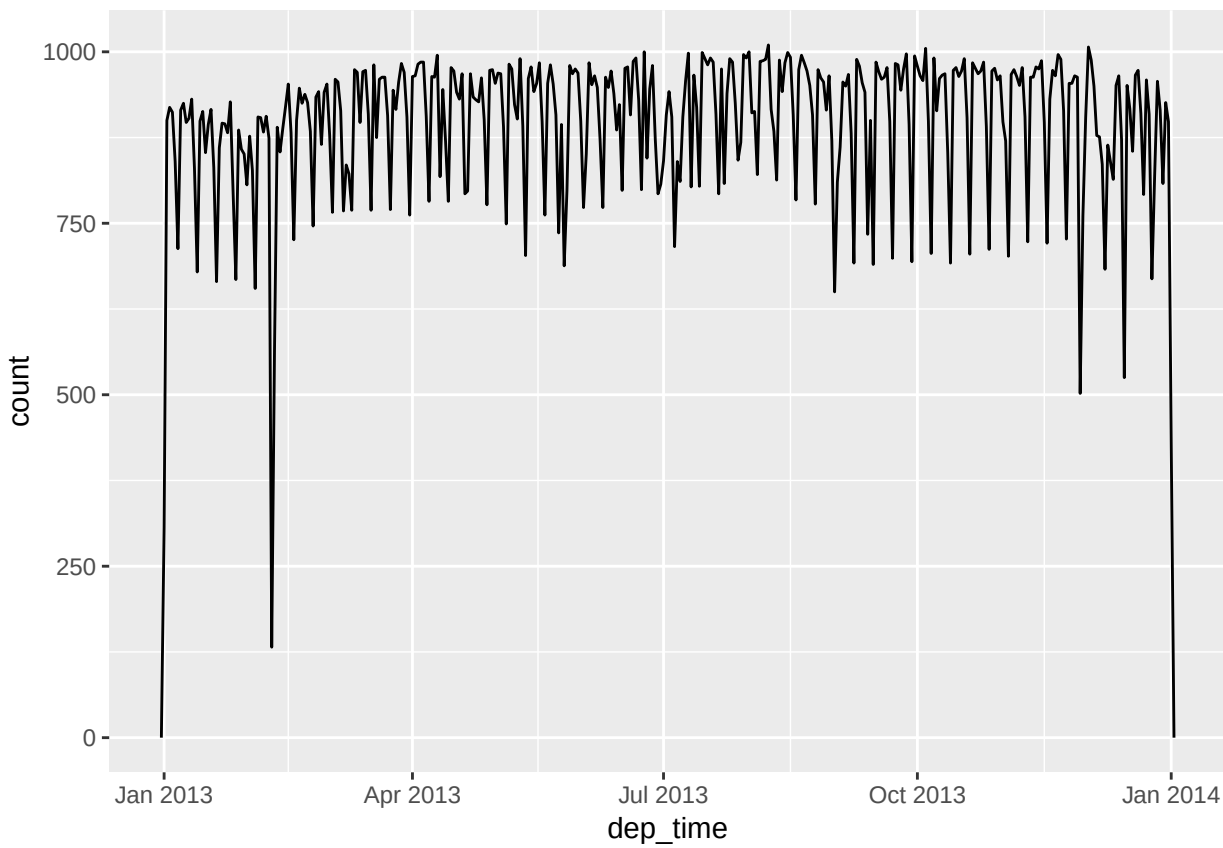
```r
flights %>%
  select(year, month, day, hour, minute) %>%
  mutate(departure = make_datetime(year, month, day, hour, minute))
```

```
## # A tibble: 336,776 x 6
##     year month   day  hour minute departure
##    <int> <int> <int> <dbl>  <dbl> <dttm>
##  1  2013     1     1     5     15 2013-01-01 05:15:00
##  2  2013     1     1     5     29 2013-01-01 05:29:00
##  3  2013     1     1     5     40 2013-01-01 05:40:00
##  4  2013     1     1     5     45 2013-01-01 05:45:00
##  5  2013     1     1     6      0 2013-01-01 06:00:00
##  6  2013     1     1     5     58 2013-01-01 05:58:00
##  7  2013     1     1     6      0 2013-01-01 06:00:00
##  8  2013     1     1     6      0 2013-01-01 06:00:00
##  9  2013     1     1     6      0 2013-01-01 06:00:00
## 10  2013     1     1     6      0 2013-01-01 06:00:00
## # ... with 336,766 more rows
```

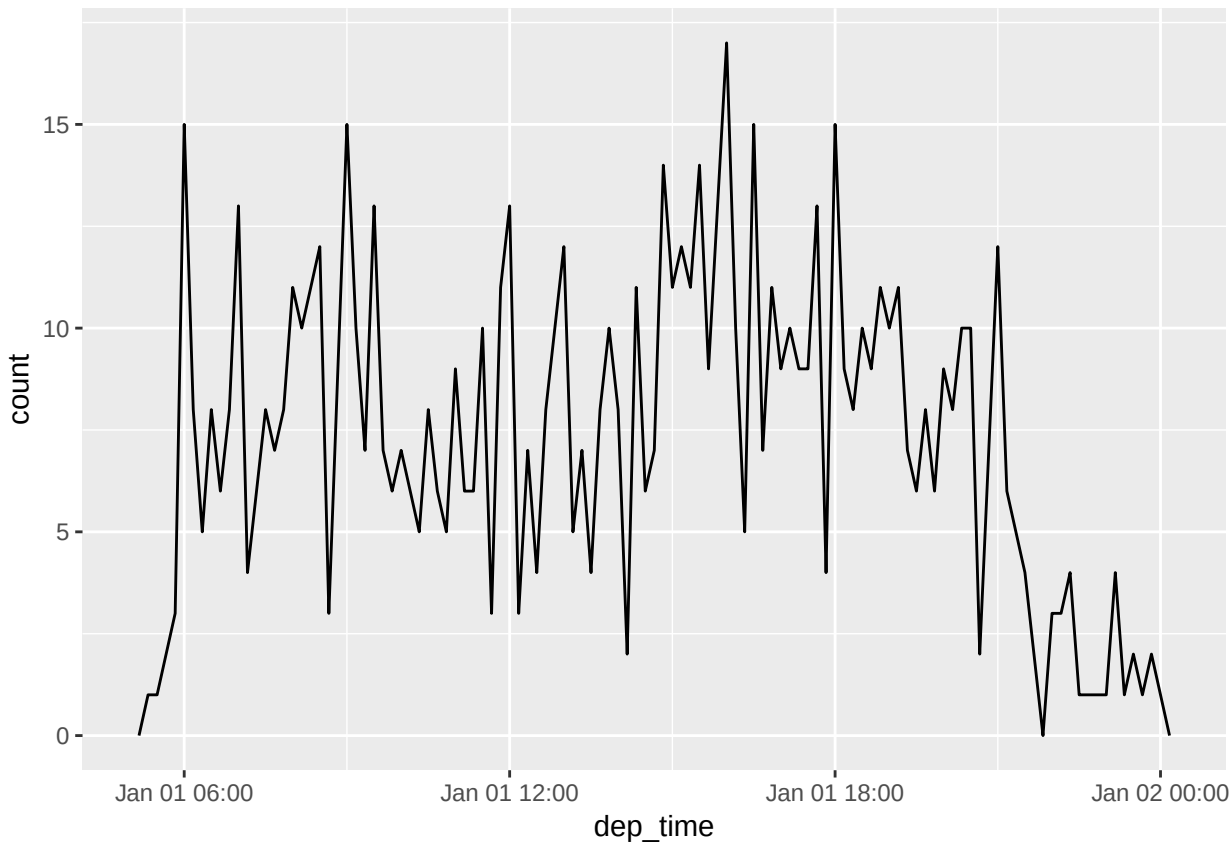
```r
make_datetime_100 <- function(year, month, day, time) {
  make_datetime(year, month, day, time %/% 100, time %% 100)
}

flights_dt <- flights %>%
  filter(!is.na(dep_time), !is.na(arr_time)) %>%
  mutate(
    dep_time = make_datetime_100(year, month, day, dep_time),
    arr_time = make_datetime_100(year, month, day, arr_time),
    sched_dep_time = make_datetime_100(year, month, day, sched_dep_time),
    sched_arr_time = make_datetime_100(year, month, day, sched_arr_time)
  ) %>%
  select(origin, dest, ends_with("delay"), ends_with("time"))

flights_dt
```

```
## # A tibble: 328,063 x 9
##    origin dest  dep_delay arr_delay dep_time            sched_dep_time
##    <chr>  <chr>     <dbl>     <dbl> <dttm>              <dttm>
##  1 EWR    IAH           2        11 2013-01-01 05:17:00 2013-01-01 05:15:00
##  2 LGA    IAH           4        20 2013-01-01 05:33:00 2013-01-01 05:29:00
##  3 JFK    MIA           2        33 2013-01-01 05:42:00 2013-01-01 05:40:00
##  4 JFK    BQN          -1       -18 2013-01-01 05:44:00 2013-01-01 05:45:00
##  5 LGA    ATL          -6       -25 2013-01-01 05:54:00 2013-01-01 06:00:00
##  6 EWR    ORD          -4        12 2013-01-01 05:54:00 2013-01-01 05:58:00
##  7 EWR    FLL          -5        19 2013-01-01 05:55:00 2013-01-01 06:00:00
##  8 LGA    IAD          -3       -14 2013-01-01 05:57:00 2013-01-01 06:00:00
##  9 JFK    MCO          -3        -8 2013-01-01 05:57:00 2013-01-01 06:00:00
## 10 LGA    ORD          -2         8 2013-01-01 05:58:00 2013-01-01 06:00:00
## # ... with 328,053 more rows, and 3 more variables: arr_time <dttm>,
## #   sched_arr_time <dttm>, air_time <dbl>
```

```
flights_dt %>%
  ggplot(aes(dep_time)) +
  geom_freqpoly(binwidth = 86400) # 86400 seconds = 1 day
```




```
flights_dt %>%
  filter(dep_time < ymd(20130102)) %>%
  ggplot(aes(dep_time)) +
  geom_freqpoly(binwidth = 600) # 600 s = 10 minutes
```



Getting the components

```
datetime <- ymd_hms("2016-07-08 12:34:56")

year(datetime)
```

```
## [1] 2016
```

```
month(datetime)
```

```
## [1] 7
```

```
mday(datetime)
```

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

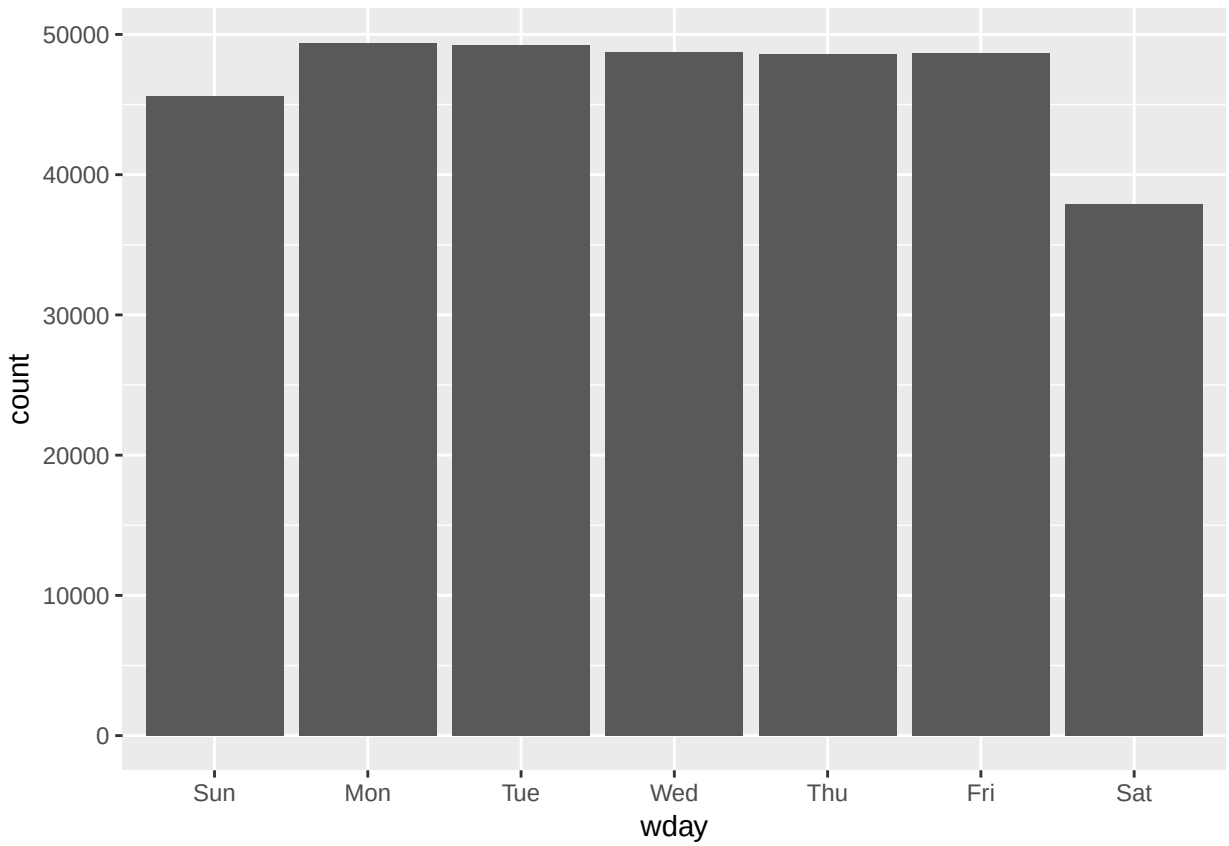
```
yday(datetime)
```

```
## [1] 190
```

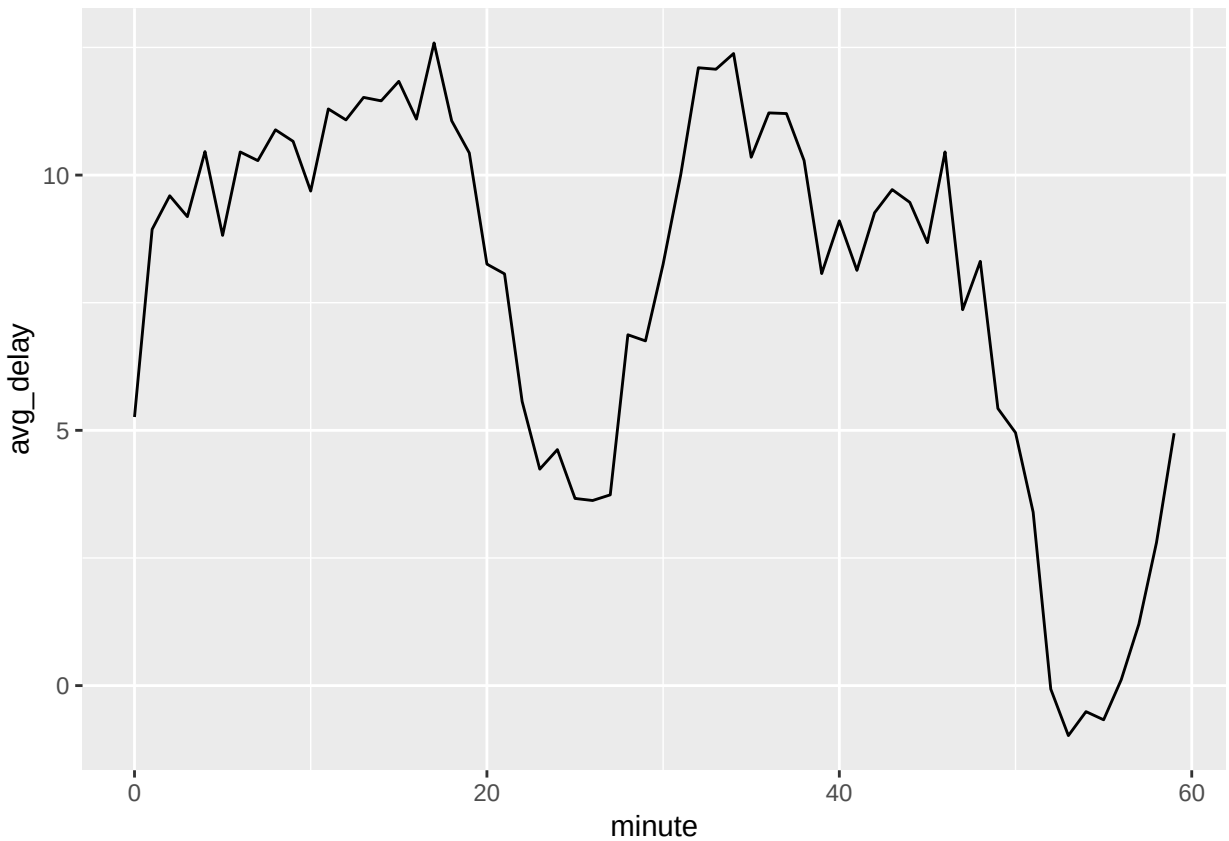
```
wday(datetime)
```

```
## [1] 6
```

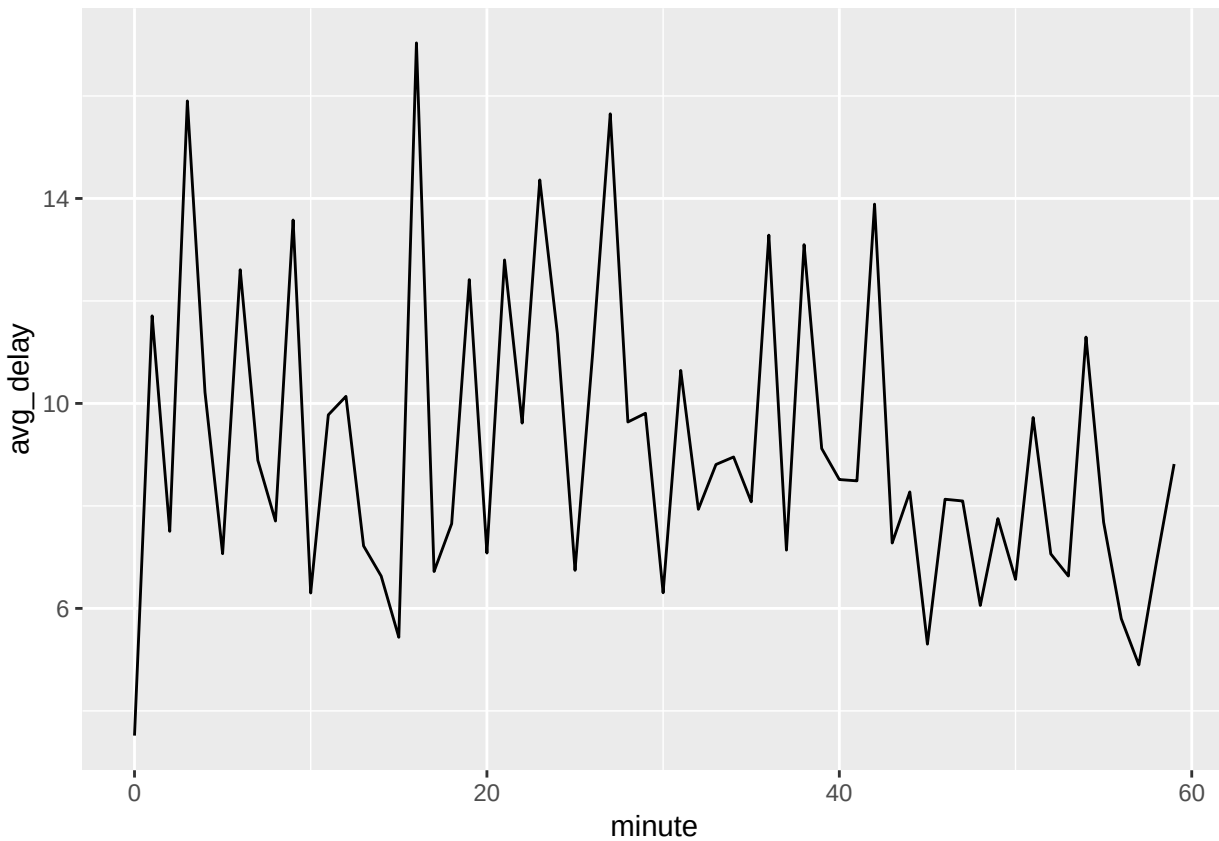
```
flights_dt %>%
  mutate(wday = wday(dep_time, label = TRUE)) %>%
  ggplot(aes(x = wday)) +
    geom_bar()
```




```
flights_dt %>%
  mutate(minute = minute(dep_time)) %>%
  group_by(minute) %>%
  summarise(
    avg_delay = mean(arr_delay, na.rm = TRUE),
    n = n()) %>%
  ggplot(aes(minute, avg_delay)) +
    geom_line()
```




```
sched_dep <- flights_dt %>%
  mutate(minute = minute(sched_dep_time)) %>%
  group_by(minute) %>%
  summarise(
    avg_delay = mean(arr_delay, na.rm = TRUE),
    n = n())

ggplot(sched_dep, aes(minute, avg_delay)) +
  geom_line()
```



Time zones

```
Sys.timezone()
```

```
## [1] "America/Los_Angeles"
```

All of the time zones

```
length(OlsonNames())
```

```
## [1] 606
```

```
head(OlsonNames())
```

```
## [1] "Africa/Abidjan"     "Africa/Accra"       "Africa/Addis_Ababa"
## [4] "Africa/Algiers"     "Africa/Asmara"      "Africa/Asmera"
```

```
(x1 <- ymd_hms("2015-06-01 12:00:00", tz = "America/New_York"))
```

```
## [1] "2015-06-01 12:00:00 EDT"
```

```
(x2 <- ymd_hms("2015-06-01 18:00:00", tz = "Europe/Copenhagen"))
```

```
## [1] "2015-06-01 18:00:00 CEST"
```

```
(x3 <- ymd_hms("2015-06-02 04:00:00", tz = "Pacific/Auckland"))
```

```
## [1] "2015-06-02 04:00:00 NZST"
```