sunrise and set

```
CAsb <- read.csv("~/gitRepos/teaching/ResearchCircle2020/ca_san_bernardino_2019_08_13.csv")
str(CAsb)
```

```
## 'data.frame':    90523 obs. of  12 variables:
##  $ raw_row_number : Factor w/ 90523 levels "1","1000|1001",..: 11533 11532 11531 11529 11528 11527 11
##  $ date           : Factor w/ 2108 levels "2011-12-13","2011-12-14",..: 1 1 1 1 1 1 1 1 1 ...
##  $ time           : Factor w/ 53629 levels "00:00:03","00:00:07",..: 7024 10634 10832 10852 10922 109
##  $ location       : Factor w/ 21610 levels ",MCDONALDS HL/G",..: 5572 14393 21216 7541 7541 10903 791
##  $ lat            : num  34.1 NA 34.1 34.1 34.1 ...
##  $ lng            : num  -117 NA -117 -117 -117 ...
##  $ type           : Factor w/ 1 level "vehicular": NA 1 1 1 1 1 1 1 1 ...
##  $ disposition    : Factor w/ 652 levels "ADM","ADM|ADV",..: 9 9 9 9 9 9 233 233 510 233 ...
##  $ arrest_made    : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ citation_issued: logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ outcome        : Factor w/ 2 levels "arrest","citation": NA NA NA NA NA NA 2 2 NA 2 ...
##  $ raw_CallType   : Factor w/ 2 levels "CKS","T": 1 2 2 2 2 2 2 2 2 2 ...
```

1. First I notice two things about the date/time. (1) they are coded as factors (they should be dates, but at the very minimum, characters), (2) they are separate columns, and they might need to be combined.

NOTICE THE DIFFERENT TYPES OF VARIABLES IN THE COLUMN HEADERS!!!

```
CAsb <- CAsb %>%
  dplyr::mutate(datetime = lubridate::ymd_hms(paste(as.character(date), as.character(time))),
                date2 = lubridate::as_date(lubridate::ymd(as.character(date))))

# check to make sure it did what we wanted it to do
CAsb %>%
  select(date, date2, time, datetime) %>%
  head()
```

```
##         date      date2     time            datetime
## 1 2011-12-13 2011-12-13 04:23:19 2011-12-13 04:23:19
## 2 2011-12-13 2011-12-13 07:14:51 2011-12-13 07:14:51
## 3 2011-12-13 2011-12-13 07:20:38 2011-12-13 07:20:38
## 4 2011-12-13 2011-12-13 07:21:08 2011-12-13 07:21:08
## 5 2011-12-13 2011-12-13 07:22:59 2011-12-13 07:22:59
## 6 2011-12-13 2011-12-13 07:23:59 2011-12-13 07:23:59
```

2. Next I tried many of the bazillion different functions in R that will calculate the sunrise times. They each had a very specific format for the date/time required. Also, many of them had trouble with situations where lat and/or long was missing. The function `getSunlightTimes` in the package `suncalc` seems to deal well with missing information.

For multiple lat/long/dates, the `data=` argument is required.

```
temp <- data.frame(date = CAsb$date2, lat = CAsb$lat, lon = CAsb$lng)

getSunlightTimes(data = temp, keep = "sunrise") %>%
  head()
```

```
##         date      lat       lon             sunrise
## 1 2011-12-13 34.12160 -117.2782 2011-12-13 14:47:29
## 2 2011-12-13       NA        NA                <NA>
```

```
## 3 2011-12-13 34.11289 -117.2756 2011-12-13 14:47:27
## 4 2011-12-13 34.07797 -117.2815 2011-12-13 14:47:23
## 5 2011-12-13 34.07797 -117.2815 2011-12-13 14:47:23
## 6 2011-12-13       NA        NA                <NA>
```

3. Next I wrote a function (got this idea from the Stack Overflow page when looking at `sunriset`).

```
oursunriseset <- function(latitude, longitude, date, direction = c("sunrise", "sunset")) {
  date.lat.long <- data.frame(date = date, lat = latitude, lon = longitude)
  if(direction == "sunrise"){
    getSunlightTimes(data = date.lat.long, keep=direction)$sunrise }else{
    getSunlightTimes(data = date.lat.long, keep=direction)$sunset  }
}
```

4. Let's check to make sure the function works how we think it should. Remember that we need it to keep only the **one** column associated with the sunrise (or sunset).

```
oursunriseset(CAsb$lat, CAsb$lng, CAsb$date2, direction = "sunrise") %>% head()
```

```
## [1] "2011-12-13 14:47:29 UTC" NA
## [3] "2011-12-13 14:47:27 UTC" "2011-12-13 14:47:23 UTC"
## [5] "2011-12-13 14:47:23 UTC" NA
```

5. Let's use it in the mutate function!

```
CAsb %>%
  dplyr::mutate(sunrise = oursunriseset(lat, lng, date2, direction = "sunrise"),
                sunset = oursunriseset(lat, lng, date2, direction = "sunset")) %>%
  select(date, time, date2, lat, lng, sunrise, sunset) %>%
  head()
```

```
##         date     time      date2      lat       lng             sunrise
## 1 2011-12-13 04:23:19 2011-12-13 34.12160 -117.2782 2011-12-13 14:47:29
## 2 2011-12-13 07:14:51 2011-12-13       NA        NA                <NA>
## 3 2011-12-13 07:20:38 2011-12-13 34.11289 -117.2756 2011-12-13 14:47:27
## 4 2011-12-13 07:21:08 2011-12-13 34.07797 -117.2815 2011-12-13 14:47:23
## 5 2011-12-13 07:22:59 2011-12-13 34.07797 -117.2815 2011-12-13 14:47:23
## 6 2011-12-13 07:23:59 2011-12-13       NA        NA                <NA>
##                sunset
## 1 2011-12-14 00:41:52
## 2                <NA>
## 3 2011-12-14 00:41:53
## 4 2011-12-14 00:42:00
## 5 2011-12-14 00:42:00
## 6                <NA>
```