Data Manipulation with the Lubridate package

Introduction

Have you ever had data with date and time entries? Dealing with this type of data is tricky because it's hard to get R to agree that it is date/time data.

Well luckily there's an R package for you! `lubridate` is an R package that helps make it easier to work with dates and times in data. `lubridate` has many different ways to manipulate dates and times to your advantage, which I'll describe later below.

Motivation

My motivation towards this topic stems from trying to find a good way to deal with dates and times, because in my experience it's hard to deal with this type of data. Having a package to help work with this data would be really nice for me in the future, and I'm sure it'll be of use for you as well when working with data, considering dates and times are important types of data to work with.

Background - Packages Needed Before We Start

Before we get into the examples, let's go into what you need in order to follow along. Firstly, if you haven't already, install the `lubridate` package, like below:

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

Then load the package.

```
library(lubridate)
```

```
## Warning: package 'lubridate' was built under R version 3.3.2
```

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

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

Once that's done, you have the required packages you need to follow along! Pretty simple. So let's start…

Discussion/Examples

A Simple Example

Let's start with something basic. Below is a object in date form:

```
20170215
```

```
## [1] 20170215
```

We can parse this date and arrange it in a nice format. To do this with the particular example above, we use the `ymd` method, as seen below:

```
# Converting to nice object
ymd(20170215)
```

```
## [1] "2017-02-15"
```

We can also take in other date formats, such as mdy (month-day-year) and dmy (day-month-year) and convert those into a nice format like above with the methods `mdy` and `dmy` respectively. Here's the example:

```
mdy("02-15-2017")
```

```
## [1] "2017-02-15"
```

```
dmy("15/02/2017")
```

```
## [1] "2017-02-15"
```

Pretty nice. But that's a pretty simplistic example, so let's go further.

Extracting information From Date/Time Objects

We can also extract specific information from the date/time object. For example, let's say we have this object:

```
# Just a random object
date <- ymd_hms("2017-02-01 13:00:00")
```

Now say we want the minute of this object. Simple, just use `minute`:

```
minute(date)
```

```
## [1] 0
```

We can also set the minute using the same method:

```
minute(date) <- 30
date
```

```
## [1] "2017-02-01 13:30:00 UTC"
```

What's cool is that we can also get the specific day of a date object, like Tuesday. Let's see what day February 1st, 2017 was…

```
wday(date)
```

```
## [1] 4
```

Hmm… that doesn't tell us much. That's because it's a numeric label. If we want the actual day in all its string glory, we need to set `label = TRUE`:

```
wday(date, label = TRUE)
```

```
## [1] Wed
## Levels: Sun < Mon < Tue < Wed < Thu < Fri < Sat
```

And that's how we find out my birthday this year was on a Wednesday.

Time Zones?!

Yes, `lubridate` has functionality to include time zones! Maybe that's just me, but I think that's pretty cool! Let's start off by creating an object:

```
birthdate <- ymd_hms("1997-02-01 19:00:00", tz = "Asia/Seoul")
```

In the above object `birthdate`, I created a datetime object with my birthdate/time and where I was born. In other words, I was born on February 1st, 1997 at around 7pm in Seoul, South Korea.

Now what if I wanted to know what time it was in Los Angeles when I was born? Let's see Los Angeles is 15 hours ahead of Seoul, so that's… but wait I need to account for Daylight Saving's so maybe it was 14 hours… or was it 13? I don't remember…

Well, instead of doing all that, `lubridate` can help convert all that, thanks to the `with_tz` function:

```
with_tz(birthdate, "America/Los_Angeles")
```

```
## [1] "1997-02-01 02:00:00 PST"
```

That's pretty neat! Now you're probably wondering: "how are you getting the correct time zone names?" It's thanks to this function that lists all of the different time zones:

```
OlsonNames()
```

```
##   [1] "Africa/Abidjan"                 "Africa/Accra"
##   [3] "Africa/Addis_Ababa"             "Africa/Algiers"
##   [5] "Africa/Asmara"                  "Africa/Asmera"
##   [7] "Africa/Bamako"                  "Africa/Bangui"
##   [9] "Africa/Banjul"                  "Africa/Bissau"
##  [11] "Africa/Blantyre"                "Africa/Brazzaville"
##  [13] "Africa/Bujumbura"               "Africa/Cairo"
##  [15] "Africa/Casablanca"              "Africa/Ceuta"
##  [17] "Africa/Conakry"                 "Africa/Dakar"
##  [19] "Africa/Dar_es_Salaam"           "Africa/Djibouti"
##  [21] "Africa/Douala"                  "Africa/El_Aaiun"
##  [23] "Africa/Freetown"                "Africa/Gaborone"
##  [25] "Africa/Harare"                  "Africa/Johannesburg"
##  [27] "Africa/Juba"                    "Africa/Kampala"
##  [29] "Africa/Khartoum"                "Africa/Kigali"
##  [31] "Africa/Kinshasa"                "Africa/Lagos"
##  [33] "Africa/Libreville"              "Africa/Lome"
##  [35] "Africa/Luanda"                  "Africa/Lubumbashi"
##  [37] "Africa/Lusaka"                  "Africa/Malabo"
##  [39] "Africa/Maputo"                  "Africa/Maseru"
##  [41] "Africa/Mbabane"                 "Africa/Mogadishu"
##  [43] "Africa/Monrovia"                "Africa/Nairobi"
##  [45] "Africa/Ndjamena"                "Africa/Niamey"
##  [47] "Africa/Nouakchott"              "Africa/Ouagadougou"
```

```
##  [49] "Africa/Porto-Novo"                "Africa/Sao_Tome"
##  [51] "Africa/Timbuktu"                  "Africa/Tripoli"
##  [53] "Africa/Tunis"                     "Africa/Windhoek"
##  [55] "America/Adak"                     "America/Anchorage"
##  [57] "America/Anguilla"                 "America/Antigua"
##  [59] "America/Araguaina"                "America/Argentina/Buenos_Aires"
##  [61] "America/Argentina/Catamarca"      "America/Argentina/ComodRivadavia"
##  [63] "America/Argentina/Cordoba"        "America/Argentina/Jujuy"
##  [65] "America/Argentina/La_Rioja"       "America/Argentina/Mendoza"
##  [67] "America/Argentina/Rio_Gallegos"   "America/Argentina/Salta"
##  [69] "America/Argentina/San_Juan"       "America/Argentina/San_Luis"
##  [71] "America/Argentina/Tucuman"        "America/Argentina/Ushuaia"
##  [73] "America/Aruba"                    "America/Asuncion"
##  [75] "America/Atikokan"                 "America/Atka"
##  [77] "America/Bahia"                    "America/Bahia_Banderas"
##  [79] "America/Barbados"                 "America/Belem"
##  [81] "America/Belize"                   "America/Blanc-Sablon"
##  [83] "America/Boa_Vista"                "America/Bogota"
##  [85] "America/Boise"                    "America/Buenos_Aires"
##  [87] "America/Cambridge_Bay"            "America/Campo_Grande"
##  [89] "America/Cancun"                   "America/Caracas"
##  [91] "America/Catamarca"                "America/Cayenne"
##  [93] "America/Cayman"                   "America/Chicago"
##  [95] "America/Chihuahua"                "America/Coral_Harbour"
##  [97] "America/Cordoba"                  "America/Costa_Rica"
##  [99] "America/Creston"                  "America/Cuiaba"
## [101] "America/Curacao"                  "America/Danmarkshavn"
## [103] "America/Dawson"                   "America/Dawson_Creek"
## [105] "America/Denver"                   "America/Detroit"
## [107] "America/Dominica"                 "America/Edmonton"
## [109] "America/Eirunepe"                 "America/El_Salvador"
## [111] "America/Ensenada"                 "America/Fort_Nelson"
## [113] "America/Fort_Wayne"               "America/Fortaleza"
## [115] "America/Glace_Bay"                "America/Godthab"
## [117] "America/Goose_Bay"                "America/Grand_Turk"
## [119] "America/Grenada"                  "America/Guadeloupe"
## [121] "America/Guatemala"                "America/Guayaquil"
## [123] "America/Guyana"                   "America/Halifax"
## [125] "America/Havana"                   "America/Hermosillo"
## [127] "America/Indiana/Indianapolis"     "America/Indiana/Knox"
## [129] "America/Indiana/Marengo"          "America/Indiana/Petersburg"
## [131] "America/Indiana/Tell_City"        "America/Indiana/Vevay"
## [133] "America/Indiana/Vincennes"        "America/Indiana/Winamac"
## [135] "America/Indianapolis"             "America/Inuvik"
## [137] "America/Iqaluit"                  "America/Jamaica"
## [139] "America/Jujuy"                    "America/Juneau"
## [141] "America/Kentucky/Louisville"      "America/Kentucky/Monticello"
## [143] "America/Knox_IN"                  "America/Kralendijk"
## [145] "America/La_Paz"                   "America/Lima"
## [147] "America/Los_Angeles"              "America/Louisville"
## [149] "America/Lower_Princes"            "America/Maceio"
## [151] "America/Managua"                  "America/Manaus"
## [153] "America/Marigot"                  "America/Martinique"
## [155] "America/Matamoros"                "America/Mazatlan"
## [157] "America/Mendoza"                  "America/Menominee"
## [159] "America/Merida"                   "America/Metlakatla"
## [161] "America/Mexico_City"              "America/Miquelon"
## [163] "America/Moncton"                  "America/Monterrey"
## [165] "America/Montevideo"               "America/Montreal"
## [167] "America/Montserrat"               "America/Nassau"
## [169] "America/New_York"                 "America/Nipigon"
## [171] "America/Nome"                     "America/Noronha"
## [173] "America/North_Dakota/Beulah"      "America/North_Dakota/Center"
## [175] "America/North_Dakota/New_Salem"   "America/Ojinaga"
## [177] "America/Panama"                   "America/Pangnirtung"
## [179] "America/Paramaribo"               "America/Phoenix"
## [181] "America/Port_of_Spain"            "America/Port-au-Prince"
## [183] "America/Porto_Acre"               "America/Porto_Velho"
## [185] "America/Puerto_Rico"              "America/Rainy_River"
## [187] "America/Rankin_Inlet"             "America/Recife"
## [189] "America/Regina"                   "America/Resolute"
## [191] "America/Rio_Branco"               "America/Rosario"
## [193] "America/Santa_Isabel"             "America/Santarem"
## [195] "America/Santiago"                 "America/Santo_Domingo"
## [197] "America/Sao_Paulo"                "America/Scoresbysund"
## [199] "America/Shiprock"                 "America/Sitka"
## [201] "America/St_Barthelemy"            "America/St_Johns"
## [203] "America/St_Kitts"                 "America/St_Lucia"
## [205] "America/St_Thomas"                "America/St_Vincent"
## [207] "America/Swift_Current"            "America/Tegucigalpa"
## [209] "America/Thule"                    "America/Thunder_Bay"
## [211] "America/Tijuana"                  "America/Toronto"
## [213] "America/Tortola"                  "America/Vancouver"
## [215] "America/Virgin"                   "America/Whitehorse"
## [217] "America/Winnipeg"                 "America/Yakutat"
```

```
## [219] "America/Yellowknife"             "Antarctica/Casey"
## [221] "Antarctica/Davis"                "Antarctica/DumontDUrville"
## [223] "Antarctica/Macquarie"            "Antarctica/Mawson"
## [225] "Antarctica/McMurdo"              "Antarctica/Palmer"
## [227] "Antarctica/Rothera"              "Antarctica/South_Pole"
## [229] "Antarctica/Syowa"                "Antarctica/Troll"
## [231] "Antarctica/Vostok"               "Arctic/Longyearbyen"
## [233] "Asia/Aden"                       "Asia/Almaty"
## [235] "Asia/Amman"                      "Asia/Anadyr"
## [237] "Asia/Aqtau"                      "Asia/Aqtobe"
## [239] "Asia/Ashgabat"                   "Asia/Ashkhabad"
## [241] "Asia/Baghdad"                    "Asia/Bahrain"
## [243] "Asia/Baku"                       "Asia/Bangkok"
## [245] "Asia/Barnaul"                    "Asia/Beirut"
## [247] "Asia/Bishkek"                    "Asia/Brunei"
## [249] "Asia/Calcutta"                   "Asia/Chita"
## [251] "Asia/Choibalsan"                 "Asia/Chongqing"
## [253] "Asia/Chungking"                  "Asia/Colombo"
## [255] "Asia/Dacca"                      "Asia/Damascus"
## [257] "Asia/Dhaka"                      "Asia/Dili"
## [259] "Asia/Dubai"                      "Asia/Dushanbe"
## [261] "Asia/Gaza"                       "Asia/Harbin"
## [263] "Asia/Hebron"                     "Asia/Ho_Chi_Minh"
## [265] "Asia/Hong_Kong"                  "Asia/Hovd"
## [267] "Asia/Irkutsk"                    "Asia/Istanbul"
## [269] "Asia/Jakarta"                    "Asia/Jayapura"
## [271] "Asia/Jerusalem"                  "Asia/Kabul"
## [273] "Asia/Kamchatka"                  "Asia/Karachi"
## [275] "Asia/Kashgar"                    "Asia/Kathmandu"
## [277] "Asia/Katmandu"                   "Asia/Khandyga"
## [279] "Asia/Kolkata"                    "Asia/Krasnoyarsk"
## [281] "Asia/Kuala_Lumpur"               "Asia/Kuching"
## [283] "Asia/Kuwait"                     "Asia/Macao"
## [285] "Asia/Macau"                      "Asia/Magadan"
## [287] "Asia/Makassar"                   "Asia/Manila"
## [289] "Asia/Muscat"                     "Asia/Nicosia"
## [291] "Asia/Novokuznetsk"               "Asia/Novosibirsk"
## [293] "Asia/Omsk"                       "Asia/Oral"
## [295] "Asia/Phnom_Penh"                 "Asia/Pontianak"
## [297] "Asia/Pyongyang"                  "Asia/Qatar"
## [299] "Asia/Qyzylorda"                  "Asia/Rangoon"
## [301] "Asia/Riyadh"                     "Asia/Saigon"
## [303] "Asia/Sakhalin"                   "Asia/Samarkand"
## [305] "Asia/Seoul"                      "Asia/Shanghai"
## [307] "Asia/Singapore"                  "Asia/Srednekolymsk"
## [309] "Asia/Taipei"                     "Asia/Tashkent"
## [311] "Asia/Tbilisi"                    "Asia/Tehran"
## [313] "Asia/Tel_Aviv"                   "Asia/Thimbu"
## [315] "Asia/Thimphu"                    "Asia/Tokyo"
## [317] "Asia/Tomsk"                      "Asia/Ujung_Pandang"
## [319] "Asia/Ulaanbaatar"                "Asia/Ulan_Bator"
## [321] "Asia/Urumqi"                     "Asia/Ust-Nera"
## [323] "Asia/Vientiane"                  "Asia/Vladivostok"
## [325] "Asia/Yakutsk"                    "Asia/Yekaterinburg"
## [327] "Asia/Yerevan"                    "Atlantic/Azores"
## [329] "Atlantic/Bermuda"                "Atlantic/Canary"
## [331] "Atlantic/Cape_Verde"             "Atlantic/Faeroe"
## [333] "Atlantic/Faroe"                  "Atlantic/Jan_Mayen"
## [335] "Atlantic/Madeira"                "Atlantic/Reykjavik"
## [337] "Atlantic/South_Georgia"          "Atlantic/St_Helena"
## [339] "Atlantic/Stanley"                "Australia/ACT"
## [341] "Australia/Adelaide"              "Australia/Brisbane"
## [343] "Australia/Broken_Hill"           "Australia/Canberra"
## [345] "Australia/Currie"                "Australia/Darwin"
## [347] "Australia/Eucla"                 "Australia/Hobart"
## [349] "Australia/LHI"                   "Australia/Lindeman"
## [351] "Australia/Lord_Howe"             "Australia/Melbourne"
## [353] "Australia/North"                 "Australia/NSW"
## [355] "Australia/Perth"                 "Australia/Queensland"
## [357] "Australia/South"                 "Australia/Sydney"
## [359] "Australia/Tasmania"              "Australia/Victoria"
## [361] "Australia/West"                  "Australia/Yancowinna"
## [363] "Brazil/Acre"                     "Brazil/DeNoronha"
## [365] "Brazil/East"                     "Brazil/West"
## [367] "Canada/Atlantic"                 "Canada/Central"
## [369] "Canada/East-Saskatchewan"        "Canada/Eastern"
## [371] "Canada/Mountain"                 "Canada/Newfoundland"
## [373] "Canada/Pacific"                  "Canada/Saskatchewan"
## [375] "Canada/Yukon"                    "CET"
## [377] "Chile/Continental"               "Chile/EasterIsland"
## [379] "CST6CDT"                         "Cuba"
## [381] "EET"                             "Egypt"
## [383] "Eire"                            "EST"
## [385] "EST5EDT"                         "Etc/GMT"
## [387] "Etc/GMT-0"                       "Etc/GMT-1"
```

```
## [389] "Etc/GMT-10"                    "Etc/GMT-11"
## [391] "Etc/GMT-12"                    "Etc/GMT-13"
## [393] "Etc/GMT-14"                    "Etc/GMT-2"
## [395] "Etc/GMT-3"                     "Etc/GMT-4"
## [397] "Etc/GMT-5"                     "Etc/GMT-6"
## [399] "Etc/GMT-7"                     "Etc/GMT-8"
## [401] "Etc/GMT-9"                     "Etc/GMT+0"
## [403] "Etc/GMT+1"                     "Etc/GMT+10"
## [405] "Etc/GMT+11"                    "Etc/GMT+12"
## [407] "Etc/GMT+2"                     "Etc/GMT+3"
## [409] "Etc/GMT+4"                     "Etc/GMT+5"
## [411] "Etc/GMT+6"                     "Etc/GMT+7"
## [413] "Etc/GMT+8"                     "Etc/GMT+9"
## [415] "Etc/GMT0"                      "Etc/Greenwich"
## [417] "Etc/UCT"                       "Etc/Universal"
## [419] "Etc/UTC"                       "Etc/Zulu"
## [421] "Europe/Amsterdam"              "Europe/Andorra"
## [423] "Europe/Astrakhan"              "Europe/Athens"
## [425] "Europe/Belfast"                "Europe/Belgrade"
## [427] "Europe/Berlin"                 "Europe/Bratislava"
## [429] "Europe/Brussels"               "Europe/Bucharest"
## [431] "Europe/Budapest"               "Europe/Busingen"
## [433] "Europe/Chisinau"               "Europe/Copenhagen"
## [435] "Europe/Dublin"                 "Europe/Gibraltar"
## [437] "Europe/Guernsey"               "Europe/Helsinki"
## [439] "Europe/Isle_of_Man"            "Europe/Istanbul"
## [441] "Europe/Jersey"                 "Europe/Kaliningrad"
## [443] "Europe/Kiev"                   "Europe/Kirov"
## [445] "Europe/Lisbon"                 "Europe/Ljubljana"
## [447] "Europe/London"                 "Europe/Luxembourg"
## [449] "Europe/Madrid"                 "Europe/Malta"
## [451] "Europe/Mariehamn"              "Europe/Minsk"
## [453] "Europe/Monaco"                 "Europe/Moscow"
## [455] "Europe/Nicosia"                "Europe/Oslo"
## [457] "Europe/Paris"                  "Europe/Podgorica"
## [459] "Europe/Prague"                 "Europe/Riga"
## [461] "Europe/Rome"                   "Europe/Samara"
## [463] "Europe/San_Marino"             "Europe/Sarajevo"
## [465] "Europe/Simferopol"             "Europe/Skopje"
## [467] "Europe/Sofia"                  "Europe/Stockholm"
## [469] "Europe/Tallinn"                "Europe/Tirane"
## [471] "Europe/Tiraspol"               "Europe/Ulyanovsk"
## [473] "Europe/Uzhgorod"               "Europe/Vaduz"
## [475] "Europe/Vatican"                "Europe/Vienna"
## [477] "Europe/Vilnius"                "Europe/Volgograd"
## [479] "Europe/Warsaw"                 "Europe/Zagreb"
## [481] "Europe/Zaporozhye"             "Europe/Zurich"
## [483] "GB"                            "GB-Eire"
## [485] "GMT"                           "GMT-0"
## [487] "GMT+0"                         "GMT0"
## [489] "Greenwich"                     "Hongkong"
## [491] "HST"                           "Iceland"
## [493] "Indian/Antananarivo"           "Indian/Chagos"
## [495] "Indian/Christmas"              "Indian/Cocos"
## [497] "Indian/Comoro"                 "Indian/Kerguelen"
## [499] "Indian/Mahe"                   "Indian/Maldives"
## [501] "Indian/Mauritius"              "Indian/Mayotte"
## [503] "Indian/Reunion"                "Iran"
## [505] "Israel"                        "Jamaica"
## [507] "Japan"                         "Kwajalein"
## [509] "Libya"                         "MET"
## [511] "Mexico/BajaNorte"              "Mexico/BajaSur"
## [513] "Mexico/General"                "MST"
## [515] "MST7MDT"                       "Navajo"
## [517] "NZ"                            "NZ-CHAT"
## [519] "Pacific/Apia"                  "Pacific/Auckland"
## [521] "Pacific/Bougainville"          "Pacific/Chatham"
## [523] "Pacific/Chuuk"                 "Pacific/Easter"
## [525] "Pacific/Efate"                 "Pacific/Enderbury"
## [527] "Pacific/Fakaofo"               "Pacific/Fiji"
## [529] "Pacific/Funafuti"              "Pacific/Galapagos"
## [531] "Pacific/Gambier"               "Pacific/Guadalcanal"
## [533] "Pacific/Guam"                  "Pacific/Honolulu"
## [535] "Pacific/Johnston"              "Pacific/Kiritimati"
## [537] "Pacific/Kosrae"                "Pacific/Kwajalein"
## [539] "Pacific/Majuro"                "Pacific/Marquesas"
## [541] "Pacific/Midway"                "Pacific/Nauru"
## [543] "Pacific/Niue"                  "Pacific/Norfolk"
## [545] "Pacific/Noumea"                "Pacific/Pago_Pago"
## [547] "Pacific/Palau"                 "Pacific/Pitcairn"
## [549] "Pacific/Pohnpei"               "Pacific/Ponape"
## [551] "Pacific/Port_Moresby"          "Pacific/Rarotonga"
## [553] "Pacific/Saipan"                "Pacific/Samoa"
## [555] "Pacific/Tahiti"                "Pacific/Tarawa"
## [557] "Pacific/Tongatapu"             "Pacific/Truk"
```

```
## [559] "Pacific/Wake"                "Pacific/Wallis"
## [561] "Pacific/Yap"                 "Poland"
## [563] "Portugal"                    "PRC"
## [565] "PST8PDT"                     "ROC"
## [567] "ROK"                         "Singapore"
## [569] "Turkey"                      "UCT"
## [571] "Universal"                   "US/Alaska"
## [573] "US/Aleutian"                 "US/Arizona"
## [575] "US/Central"                  "US/East-Indiana"
## [577] "US/Eastern"                  "US/Hawaii"
## [579] "US/Indiana-Starke"           "US/Michigan"
## [581] "US/Mountain"                 "US/Pacific"
## [583] "US/Pacific-New"              "US/Samoa"
## [585] "UTC"                         "VERSION"
## [587] "W-SU"                        "WET"
## [589] "Zulu"
```

Now what if I was wrong, and I was actually born in 7PM in the Los Angeles time zone. We can change the `birthdate` object by using `force_tz`:

```
oops <- force_tz(birthdate, "America/Los_Angeles")
oops
```

```
## [1] "1997-02-01 19:00:00 PST"
```

And now see what time I was actually born:

```
with_tz(oops, "Asia/Seoul")
```

```
## [1] "1997-02-02 12:00:00 KST"
```

Well looks like my birthday is February 2nd now.

Arithmetic

Yes, we can even do arithmetic with date/time objects. Let's bring back our `date` object:

```
date
```

```
## [1] "2017-02-01 13:30:00 UTC"
```

We can add to this object by using the same ideas as extracting specific fields. Just add `hours()`, `minutes()`, etc. to the date object, like below:

```
date_mod <- date + days(3) + hours(3) + minutes(3) + seconds(33)
date_mod
```

```
## [1] "2017-02-04 16:33:33 UTC"
```

Conclusions

In conclusion, `lubridate` is a really handy R package that helps manipulate date and time objects. We can convert objects, extract and set info, and use time zones in a meaningful way. If you're working with date and time objects in R, consider using `lubridate`.

References

http://data.library.virginia.edu/working-with-dates-and-time-in-r-using-the-lubridate-package/ https://rpubs.com/davoodastaraky/lubridate https://cran.r-project.org/web/packages/lubridate/vignettes/lubridate.html http://vita.had.co.nz/papers/lubridate.pdf https://www.r-bloggers.com/lubridate-working-with-date-and-time-in-r/ https://github.com/tidyverse/lubridate https://www.rdocumentation.org/packages/lubridate/versions/1.7.0 https://stackoverflow.com/questions/32211337/digging-into-r-package-time-zones-in-lubridate