MANIPULATING TIME SERIES DATA IN R WITH XTS & ZOO

Index, attributes, and time zones

What *is* the index?

Raw **seconds** since 1970-01-01 UTC

- `tclass` or `indexClass`: attribute for extraction
- `tzone` or `indexTZ`: attribute for time zones
- `indexFormat`: optional display preferences

More about the attributes

```
> indexClass(Z)
[1] “Date”

> indexTZ(Z)
[1] “UTC”
```

```
> indexFormat(Z) <- "%b %d, %Y"
> Z
                Z
Aug 09, 2016  1
Aug 10, 2016  4
```

Understanding TZ

- Describe time offset from UTC (a.k.a. Greenwich Mean Time)
- Always set your time zone to avoid surprises!

```
> Sys.setenv(TZ = "America/Chicago")
> Sys.setenv(TZ = "UTC")
```

- Know your time zones

```
> help(OlsonNames)   # Great read!
```

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Let’s practice!

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Periods, periodicity and timestamps

Final topics

- Find the time an object covers
- Find periods within your object
- Account for duplicates and false precision

periodicity()

- Identifies the regularity of data
- Answers what type of data is present
- Less useful for irregular timestamps
- Summary measure for the index

```
> periodicity(edhec)
[1] Monthly periodicity from 1997-01-31 to 2009-08-31


> periodicity(to.yearly(edhec))
[1] Yearly periodicity from 1997-12-31 to 2009-08-31
```

Counting periods

- Estimate number of periods (e.g. days, weeks)
- Irregular series equals irregular counting
- Counts periods greater than periodicity

```
> nseconds(x)
> nminutes(x)
> nhours(x)
> ndays(x)
> nweeks(x)
> nmonths(x)
> nquarters(x)
> nyears(x)
```

Broken down time with `.index*`

- Time expressed as `POSIXlt` components
  - `sec`, `min`, `hour`, `mday`, `mon`, `year`, `wday`, `yday`, `isdst`

```
> index(Z)
[1] "2016-08-09" "2016-08-10" "2016-08-11" "2016-08-12"

> .indexmday(Z)
[1]  9 10 11 12

> .indexyday(Z)
[1] 221 222 223 224

> .indexyear(Z) + 1900    # add origin
[1] 2016 2016 2016 2016
```

Modifying timestamps

- Use `align.time()` to round time stamps to another period

```
> align.time(x, n = 60)  # n is in seconds
```

- Useful to remove observations of duplicate timestamps

```
> make.index.unique(x,
                    eps = 1e-06,
                    drop = FALSE,
                    fromLast = FALSE, ...)
```

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Congratulations!

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Thank you!

This course is dedicated to the memory of Diethelm Würtz, founder of R/metrics.

Inspirational leader, mentor and friend.