

Моделирование и прогнозирование моделей сезонных временных рядов с использованием R (курс на английском языке)

Лектор: д.э.н. Деан Фантаццини

Modelling and Forecasting Seasonal Time Series models using R

Instructor: D.Sc. *Dean FANTAZZINI*

List of theoretical questions that can be asked in the exam:

- Discuss simple forecasting methods (Average method, Naive method, Seasonal naive method, Drift method) and the Box-Cox transformations
- Discuss basic models for seasonal data: Seasonal Dummy variables and Harmonic regression with Fourier terms
- Discuss decomposition methods for seasonal time series: X-11, X-12-ARIMA and X-13-ARIMA, SEATS decomposition, STL decomposition
- Discuss basic exponential smoothing methods (Simple Exponential Smoothing, Holt's method, Holt-Winters additive/multiplicative methods)
- Discuss Innovations state space models: ETS models
- Discuss Seasonal-ARIMA models
- Discuss dynamic harmonic regression and models for complex seasonality (TBATS, STL with multiple seasonal periods)
- Discuss Periodic Auto-Regressive (PAR) models
- Discuss how to test for periodic unit roots
- Discuss splines and GAM models
- Discuss the Monash Electricity Forecasting Model for the Long-term probabilistic forecasting of electricity demand

Example of applied question:

A friend of yours shows you this R code that is supposed "to do something" with the data of the central England temperature, which is available from the UK Met Office. Discuss it step-by-step.

```
CET <- url("http://www.metoffice.gov.uk/hadobs/hadcet/cetml1659on.dat")
on.exit(close(CET))
cet <- read.table(CET, sep = "", skip = 6, header = TRUE,
                 fill = TRUE, na.string = c(-99.99, -99.9))
names(cet) <- c(month.abb, "Annual")
head(cet)

cet <- cet[-nrow(cet), ]
rn <- as.numeric(rownames(cet))
Years <- rn[1]:rn[length(rn)]
cet <- cet[, -ncol(cet)]
annCET <- data.frame(Temperature = cet[, ncol(cet)], Year = Years)

cet <- stack(cet)[,2:1]
names(cet) <- c("Month", "Temperature")
cet <- transform(cet,
                 Year = (Year <- rep(Years, times = 12)),
                 nMonth = rep(1:12, each = length(Years)))
cet <- cet[with(cet, order(Year, Month)), ]
```

```
cet$Date <-lubridate::ymd(paste(cet$Year, cet$Month, "15", sep = "-"))

cet <- transform(cet, Time = as.numeric(Date) / 1000)
head(cet)

ylab <- expression(Temperature ~ (degree*C))
plot(Temperature ~ Year, data = annCET, type = "l",ylab = ylab, main = "CET")
plot(Temperature ~ Date, data = cet, type = "l", ylab = ylab)

require("mgcv")
m <- gamm(Temperature ~ s(nMonth, bs = "cc", k = 12) + s(Time),data = cet)
summary(m$gam)
layout(matrix(1:2, ncol = 2))
plot(m$gam, scale = 0)
layout(1)
```