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

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**Modelling and Forecasting Seasonal Time Series models using R**

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**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*

*- Discus 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)