Assignment 3

Instructor: Jiguo Cao

Instructions: It is due at 5pm, Monday, March 25, 2019.

1. There has been an increased demand for bicycle rentals in recent years, because renting is considered as a more economical and environmentally-friendly alternative to owning bicycles. Thus, it is of great interest to ensure a sufficient bike supply, which is critical for a successful business in this area.

   We restrict our analysis to rentals on Saturdays, in which there is a particularly high demand for casual bike rentals compared to the weekdays' bike rentals. Our goal is to study how Saturday rentals relate to the hourly temperature. Understanding the nature of this association can help predict the casual rental demand based on the weather forecast. We can estimate the following the functional linear model

   $$y_i = \mu + \int_0^{24} \beta(t)x_i(t)dt + \epsilon_i \tag{1}$$

   to address this problem, where the scalar response y_i is the total number of Saturday rentals, and the functional covariate $x_i(t)$ is the hourly temperature.

   ```
   load(file = "bike.RData")
   # Hourly temperature for 102 Saturdays
   temp = t(bike$temp)
   dim(temp)

   timepts = bike$timepts

   quartz()
   par(mfrow=c(1,1),mar = c(8, 8, 4, 2))
   matplot(timepts,temp,xlab="Hours", ylab="Temperature",
           cex.lab=1.5,cex.axis=1.5,type="l")


   # The total counts of casual bike rentals on Saturdays
   rental = bike$y
   length(rental)
   ```

   (a) (10') Please estimate $\beta(t)$ from the data.

   (b) (10') Plot the fitted values $\hat{y}_i$ vs. y_i.

   Please organize the above estimation results, and your R codes in a single pdf report.