STAT 471: Homework 3

Due: October 11, 2025 at 11:59pm

1 Instructions

Please make sure to submit your solutions to the following questions in an .rmd file or preferably a knitted html file.

2 Question 1 (50 points)

Consider the AirPassengers built-in dataset.

(a) Create a line plot of the data. You will need to use the Zoo package to handle the time series data in AirPassengers. Use the following code below to help with converting the time series object to a dataframe.

```
ap_df <- data.frame(
Date = as.Date(as.yearmon(time(AirPassengers))),
Passengers = as.numeric(AirPassengers)
)
```

(b) Recreate the same line plot, but now fit a Loess smoothed conditional mean regression curve with a 90% confidence band.
(c) Using these plots, comment on the trend that you see. What can be said about Airline Passengers' ticket purchases over time?

3 Question 2 (50 points)

You are contacted by the Long Beach Memorial Hospital and are asked for your expertise in designing a relational database management system for their Intensive Care Unit data. They tell you that every patient has a unique ID number and every nurse also has a unique ID number, but they also have an ID number that references their patient's ID number. Patients' records include their age, occupation, height in inches (rounded to the nearest whole number), and weight in pounds. Nurses' records include their age and amount of years occupied at the hospital. These are the attributes for the respective tables.

(a) Using this information, draw a UML diagram that designs the database for the Long Beach Memorial Hospital. Note that IDNumber is the primary key for the patients table and NurseID is the primary key for the Nurses table. The foreign key for the Nurses table is IDNumber, which references the patient's IDNumber attribute. Also ensure that the cardinalities are listed between the tables just like the example given in-class. *Hint.* In their system, at most one patient is assigned to a nurse's care, but multiple nurses may be assigned to a patient. This tells you the cardinality of the relationship between patients and nurses.
(b) With your UML diagram completed, create the tables with SQL along with their respective attributes and keys using SQLite and R's DBI.
(c) Make up your own values for each of your attributes and insert 5 of them into each of your tables. This means that the patients table will have 5 rows of data and the nurses table will also have 5 rows of data. Display the tables as dataframes using dbGetQuery() as shown in-class.