STAT 542: Example Homework

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Due: Yesterday

Contents

Instruction

Students are encouraged to work together on homework. However, **sharing, copying, or providing any part of a homework solution or code** is an infraction of the University's rules on Academic Integrity. Any violation will be punished as severely as possible. Final submissions must be uploaded to Gradescope. **No email or hardcopy** will be accepted. For **late submission policy and grading rubrics**, please refer to the course website.

- What is expected for the submission to **Gradescope**
  - You are required to submit one rendered **PDF** file `HWx_yourNetID.pdf`. For example, `HW01_rqzhu.pdf`. Please note that this must be a `.pdf` file generated by a `.Rmd` file. `.html` format cannot be accepted.
  - Please follow the instructions on Gradescope to select corresponding PDF pages for each question.
- Please note that your homework file is a **PDF** report instead of a messy collection of R codes. This report should **include**:
  - Your Name and NetID. (Replace `Ruoqing Zhu(rqzhu)` by your name and NetID if you are using this template).
  - Make all of your `R` code chunks visible for grading.
  - Relevant outputs from your `R` code chunks that support your answers.
  - Provide clear answers or conclusions for each question. For example, you could start with `Answer: I fit SVM with the following choice of tuning parameters ...`
  - Many assignments require your own implementation of algorithms. **Basic comments are strongly encouraged** to explain the logic to our graders. However, line-by-line code comments are unnecessary.
- Requirements regarding the `.Rmd` file.
  - You do **NOT** need to submit `Rmd` files. However, your PDF file should be rendered directly from it.

- Make sure that you **set random seeds** for simulation or randomized algorithms so that the results are reproducible. If a specific seed number is not provided in the homework, you can consider using your NetID.
- For some questions, there will be restrictions on what packages/functions you can use. Please read the requirements carefully. As long as the question does not specify such restrictions, you can use anything.

Question 1 (50 Points) Bivariate Normal Distribution

Generate 100 random variables from the bivariate Normal Distribution $\mathcal{N}(\mu, \Sigma)$, where $\mu = (1, 2)^{\mathrm{T}}$ and

$$\Sigma = \begin{pmatrix} 1 & 0.5 \\ 0.5 & 2 \end{pmatrix}$$

Use random seed 1. Report the mean vector.

Answer:

This can be done using the `mvrnorm` function in the `MASS` package:

```
library(MASS)
```

```
## Warning: package 'MASS' was built under R version 4.1.2
```

```
set.seed(1)
Sigma <- matrix(c(1,0.5,0.5,2),2,2)
mu <- c(1, 2)
X <- mvrnorm(n = 100, mu, Sigma)
```

The mean vector of these 100 observations is (1.093, 2.137).

Question 2 (50 Points) Write R Functions

Write an R function that outputs the first n terms in the Fibonacci sequence, where n is the only input value of the function. Use the function to find `fibonacci(10)`.

Answer:

```
# construct the function
fibonacci <- function(n)
{
  x = numeric(n)
  x[1:2] = c(1,1)
  for(i in 3:n) x[i] = x[i-1] + x[i-2]
  return(x)
}

# test the function
fibonacci(10)
```

```
##  [1]  1  1  2  3  5  8 13 21 34 55
```

The 10th value in a Fibonacci sequence is 55.