

114-1 –Programming and Statistical Software Quiz

(2) Question Sheet

Date: 2025/12/04 (Thu) 10:30–11:50 (80 minutes)

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Important Notes

1. **Time** (sit according to your usual seat):
 - (a) The exam will be offline (10:30–11:50). Only public computers and your USB flash drive may be used. Laptops, tablets, and mobile phones are not allowed (even if network is turned off).
 - (b) **Downloading the exam:** Within 5 minutes before the exam begins, download the exam file from the course website onto the public computer and save it to your USB.
 - i. Students who arrive late or who need to re-download the exam after disconnection must bring their USB to the instructor's laptop (points may be deducted).
 - ii. Download file: `1141-StatSoft-exam2.zip`. Unzip the file to the desktop or USB. The resulting folder should be named `"1141-StatSoft-exam2"`. (Do NOT double-click the ZIP file directly. Unzip properly! Do NOT say you don't know how to unzip files or where the file was downloaded.)
 - iii. The folder contains the question sheet, answer sheet, dataset, and some R packages (`.zip`). (Do NOT tell the instructor you cannot install R packages locally.)
 - (c) **Uploading the exam:** Upload your answer sheet within 5 minutes after the exam ends. (Students submitting early must upload using the instructor's laptop.)
2. This exam must be completed using R (Rgui or RStudio). Other software is not allowed.
3. You may consult any material: books, lecture notes, electronic files (documents, videos—headphones required).

4. Communication apps such as FB Messenger, IG, Line, etc. are strictly prohibited. Use of ChatGPT or any AI tools is prohibited. No cheating or suspicious behavior. [Please don't ruin the class!].

5. **Answer Sheet:**

- (a) Use the provided answer sheet template. MS Word filename: "Name-StatSoft-exam2.docx" (replace "Name" with your own name).
- (b) Copy the **executed R code, output, and plots** from the R Console into the answer sheet (font: **Courier New**, 10 pt, black text on white background). Not code only, not output only. (The instructor demonstrated this—please refer to the lecture video.)
- (c) Clearly label each question: e.g., # ex1(a), # ex1(b), # ex2, etc.
- (d) If your answer is incomplete or contains errors, still copy the executed R code and output. Blank answers cannot receive partial credit.

6. **Uploading the Answer Sheet:**

- (a) Log in to the course website [Assignment/Exam Upload Area] or go to <http://hmwu.nccu.edu.tw/login.html?lang=tchinese>
 - (b) Account: **statsoft**, Password: **xxxx** (announced via course FB). Folder: "20251204-exam2" .
 - (c) If the upload page displays a blank screen, move the mouse to the address bar and press Enter. If still not working, try another browser (IE/Edge/Firefox/Chrome).
 - (d) After uploading, confirm the file size. You cannot delete or re-upload. Contact the instructor if there are issues.
 - (e) **Do NOT tell the instructor your file disappeared or turned blank. Nothing can be done.**
 - (f) During disconnection, students submitting early must upload at the instructor's laptop, then may leave.
 - (g) You may practice uploading a file the day before the exam to the folder "upload_testing" .
7. If the public computer malfunctions, switch to a machine in the "Free Zone" (Micro Room 3, last two rows without fixed seats).

8. If you have questions, first try to solve them yourself. If still needed, raise your hand for help. Do not communicate with classmates.
9. If the public computer cannot read your USB, the instructor cannot fix this. (Test beforehand during regular classes.)
10. Only one instructor and one TA are present. If many students have questions, please wait patiently.
11. Use the restroom before the exam starts. No leaving the classroom during the exam without special reasons.
12. Please read all instructions carefully to ensure a smooth exam.

R Problems: All plots must be made using ggplot2

(Total 130 points)

- (10 points) Read the oath text file (`Oath.txt`), then append "(Department/Year, Student ID, Name)". Print the following oath:

I, Statistics Sophomore, 1234567, Wu Xiaoming,
solemnly abide by all exam regulations. If violated, I am willing to receive the
strictest punishment from the university. I hereby swear.

- (50 points) Follow the steps below.

- (20 points) The normal density function is

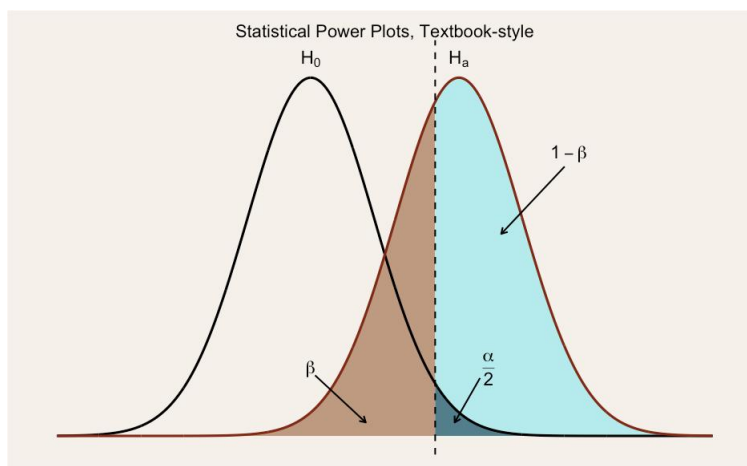
$$f(x; \mu, \sigma) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}.$$

Write an R function named `my_dnorm` with input (`x`, `mu`, `sigma`) and output the normal density `f`.

- (30 points) Using the `my_dnorm` function above, plot the figure below:

Under H_0 : mean $\mu = 0$, sd $\sigma = 1.5$. Under H_a : mean $\mu = 3.5$, sd $\sigma = 1.5$.

(Notes: (1) Do NOT use R's built-in `dnorm`. (2) Include dashed line at $x = 3$, arrows, labels, and symbols. (3) Ignore the shaded area for now.)



3. (70 points) Sales records for three Apple Stores in Taipei for January 2025 are stored in `AppleStore_Sales.txt` (simulated data). Stores: XinyiA13, Taipei101, Zhongxiao. Items: iPhone, iPad, Apple Watch. Variables: Quantity, UnitPrice, Sales.

Draw the following plots with titles and axis labels:

- (a) (20 points) Read the dataset and convert it into tidy format with columns: `Date`, `Store`, `Item`, `Quantity`, `UnitPrice`, `Sales`.
- (b) (10 points) Draw side-by-side boxplots of sales quantities for all three stores and three products (different fill colors for boxes).
- (c) (10 points) Draw a 2D grid of histograms of sales quantities: rows = stores, columns = products.
- (d) (10 points) Draw side-by-side bar plots of total January sales quantity of each product for each store (bars in different colors).
- (e) (10 points) Draw the time series of daily iPhone sales amounts for the three stores (different colored lines).
- (f) (10 points) Draw a scatter plot of iPhone quantity (x-axis) vs. iPad quantity (y-axis), using different symbols and colors for each store.