Department of Statistics
2020/21 – Semester I

STA272 – STATISTICAL COMPUTING

PRACTICAL TEST II

APR 30, 2021

Time: 19h00 – 07h00 **Marks: 100**

Instructions:

- Answer **ALL** questions.
- All of your work must be typeset using Rmarkdown and submit the printed output showing all your `R` functions.
- Any work submitted late would be penalized as follows:
  - 0 – 5 minutes late submission attracts a penalty of 10%
  - 5 – 15 minutes late submission attracts a penalty of 25%
  - 15 – 30 minutes late submission attracts a penalty of 50%
  - Otherwise you'll be awarded a **zero mark**.
- Students are allowed to use the in-built help files of `R`, Moodle learning materials and the Internet.
- Any form cheating, including any form collusion is **strictly prohibited**.
- Any plagiarized work, especially copied directly from the internet, will be awarded a **zero mark**.
- **Note that there is no one correct answer with programming and this makes it easy to identify copied work.**

Q1. The following are the final marks of students who did the STA122 course last semester.

```
52 56 56 54 48 71 58 54 44 64 69 46 51 49 60 65 40 67 43 60 59 58
55 64 61 47 63 44 46 50 69 57 50 41 53 62 60 62 55 61 47 62 38 56
49 52 62 59 58 60
```

(a) Read this data file into `R` and plot a density histogram with the following attributes:

- The x-axis range between 30 – 80.
- The plot should have no main title and the x-axis labeled Final Mark (%).
- The plot should have 8 equal bins filled `gray` color and `cornflowerblue` border lines.

(b) Overlay your density histogram with a curve of a normal distribution with mean and standard deviation of the above data. Comment on the fit.

[15+10 = 25 marks]

Q2. The `csv` file named `BWA_QGDP` in STA272 Moodle course shell consist of Botswana's **quarterly** gross domestic product (GDP) in millions of Pula from 2005 – 2018 at current prices.

(a) Use the `dplyr` package in `R` to compute the Botswana's **annual** GDP growth rate given by

$$\text{RATE}_t = \frac{\text{GDP}_t - \text{GDP}_{t-1}}{\text{GDP}_{t-1}} \times 100$$

where $t = 1, 2, \ldots, n$ is the number of years.

(b) Present the annual growth rates obtained above as a line graph and interpret your graph.

[15+10 = 25 marks]

Q3. The future value of an ordinary annuity (accumulated amount) is given by

$$S = P\left[\frac{(1 + r/n)^{nt} - 1}{r/n}\right]$$

where P is the periodic payments at the end of each period; r is the annual interest earned; n is the number of periods per year and t is the number of years.

(a) Write an `R` code that calculates future annuity value after t years. The function should take in P, r, n and t as arguments.

(b) Suppose you put P1,000 at the end of each month into a savings account that pays an annual interest of 2.75%. How long would it take in complete years for your account to be worth at least P100,000?

[13+12 = 25 marks]

Q4. This question requires the use of `gapminder` data set on life expectancy, GDP per capita, and population by country from 1952 to 2007. The data is found within its namesake `R` package.

(a) Extract the data for the top five (5) economies in Africa as measured by Gross Domestic Product (GDP) per capita (`gdpPercap`) in 2007 and state which countries are these.

(b) According to some findings in the literature, the increase in life expectancy is accompanied with the increase in GDP per capita income for rich countries. Fit a linear regression to investigate if these findings also hold for these top five countries found in (a).

[13+12 = 25 marks]

END OF THE TEST