UNIVERSITY of BOTSWANA

Department of Statistics
2020/21 – Semester II

STA272 – STATISTICAL COMPUTING

Assignment I

Due: 19-FEB-2021 **Time: 16h00**

Instructions:

- All of your work must be typeset using `Rmarkdown` and submitted online through the course's blackboard shell.
- Any work submitted late would be penalized as follows:
  - any work submitted before midnight of the due date would attract a penalty of up to 10%
  - any work submitted a day late would attract a penalty of up to 25%
  - any work submitted two days late would attract a penalty of up to 50%
  - otherwise you'll be awarded a zero mark.
- You are encouraged to discuss the assignment with others but at the end you submit your individual work. But if your work is very similar to the other students, your marks will be averaged and shared equally amongst the culprits.
- Any form cheating is not allowed and plagiarized work will be awarded a zero mark.

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1. Define the following vectors as `R` objects:

$$x = (0, 2, 5, 3, 4, 5, 2, 4, 2, 2)$$
$$y = (1, -1)$$

   Explain the process of how the following would be carried out in `R`

   (a) `sum(x*y)^2`

   (b) `sin((pi*x)/length(y))`

   (c) `y/1:6 - x`

2. Evaluate the following expressions in `R`

   (a) $\log_{\frac{2}{3}}\left(\dfrac{x^2y^4}{(x^2-y)^2}\right)$; $x = \pi$ and $y = e$.

   (b) $\sqrt[4]{\dfrac{|1-\sqrt{\pi}|}{1+\tan(1.03)}}$

3. Assume that we have the following height and weight measurements for six individuals:

```
Height (cm): 180 165 171 160 193 175
Weight (kg):  87  58  65   - 100  75
```

   (a) Create two `R` objects named `height` and `weight` corresponding to this data. Note that `-` represent missing value.

   (b) Compute the coefficient of variation, $c_v = \dfrac{\mu}{\sigma}$, of the body mass index (BMI) in `R` where BMI is defined as follows:

$$\frac{\text{weight in kg}}{(\text{height in m})^2}$$

4. Consider the following chunk of `R` code:

```
data(mammals, package = "MASS")
model.lm = lm(log(brain) ~ log(body), data = mammals)
summary(model.lm)
```

   Run this chunk of code and briefly discuss what each line of code does.

5. Let $\mathbf{A} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & -1 \\ 2 & 1 & 1 \end{bmatrix}$. Read the help documentation of the `matrix` and `eigen` functions. Hence find the matrix $\mathbf{P}$ which is made up of eigen-vectors of $\mathbf{A}$.