Homework #1

YSB801E

Due date Dec 01, 2021 00:00 EET

Q1:(10pts) Create your own expressions that calculate *variance* and *standart deviation* of an arbitrary `x` vector. Compare your results by *R*'s `var` and `sd` functions.

Q2:(10pts) $f(x) = 2x^6 - 13x^5 + 26x^4 - 7x^3 - 28x^2 + 20x$ and `x` is a numeric vector from `-1` to `3` by interval of `0.05`. Calculate *variance* and *standart deviation* of `f(x)` and plot `f(x)`.

Q3:(10pts) A dependent function chain is defined as $h(x) = \frac{log(x)-1}{\sqrt{x}}$, $g(x) = e^{\sqrt{h(x)}}$ and $f(x) = \sin g(x)^{\cos g(x)}$. If `x` is an integer array in the interval of `[20, 200]`,

- Calculate *standart deviation* and *variance* of $f(x)$.
- Calculate *minimum*, *1st quartile*, *median*, *mean*, *3th quartile* and *maximum* of f(x).

Q4:(20pts) You have a two air quality stations which first is located in the city center of Bursa and the latter one is at Uludağ. Their heights from mean sea level are $325m$ and $1743m$; and PM_{10} concentrations are $87\mu g/m^3$ and $23\mu g/m^3$, respectively. Assuming PM_{10} concentration change by height is linear, what is the PM_{10} concentration at a village that height is $640m$?

Q5:(20pts) You are an English cryptology expert in World War II and MI6 agents captured a cryptred German telegraph communication. You figured out that each letter is shifted by `3` to right in crypted text. So, write the decryption algorithm in R language and help to end the war. You can test your algorithm by the piece of text below. (*Use only English alphabet to decrypt*)

```
crypted_text <- c("z", "l", "o", "o", "n", "r", "p", "p", "h", "q")
```

Q6:(20pts) In numerical integration,

$$\int_a^b f(x)dx \approx \frac{b-a}{n} \sum_{i=1}^{n+1} f(x_i)$$

is known as mid-point rule. According to the definition, calculate the $\int_0^2 sin(x)dx$ integral.

Hint: Divide the interval [a, b] into `n` subintervals of equal width. Theoretical solution is,

$$\int_a^b sin(x)dx = cos(a) - cos(b)$$

Q7:(10pts) Write your own R question and the answer. What kind of a question would be useful for someone that just begins?

Notes:

- Please, email your answers privately to `sezenismail at gmail com`.
- Answers/codes should be in a text file named `hwX_your_full_name.py`.
- For each answer, write a comment line like `# A1` and write your answer below.

- If you dind't understand a question clearly, email your question to ysb801e@googlegroups.com.