ALGONQUIN COLLEGE

SCHOOL OF ADVANCED TECHNOLOGY

ICT - Applications & Programming
Computer Engineering Technology – Computing Science

Numerical Computing – CST8233

Term: Summer 2023

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Assignment #2 – Menus and Non-Linear Regression

In this assignment, you will use menus to prompt users with different options. You will also use non-linear regression to find the best-fit of some data and use this to extrapolate new data.

Objectives

- Create a menu system to prompt users with different options,
- Use regression to find the best fit of some data, and
- Use that fit to extrapolate new data.

Grades:

7% of your final course mark

Deadline

July 28th, 2023, 11:59 PM

Important Note

Create only one script file for this assignment. To be able to test the code, I should be able to execute the "`bestFitFun()`" function, which for this assignment serves as the equivalent of "`main()`" in other languages. You may create other functions if you wish, but we will only use that one function to launch your code for marking.

Tasks

You are given a file called "`rocket.xlsx`" that contains data on the distance travelled by a rocket launched to the moon. The distance is measured in meters every ten seconds. Write a program using R to do the following:

- Prompts the user to enter a file name. The program must verify that this file exists in the same directory. If it does not, report an error to the user and have them try again.

- Read that data in your script, and save it in a data frame named as "`rocket_data`".

- Your code must present two menus to the user:

    - First menu: asks if the user would like to perform non-linear regression to find the best fit, or to quit.

- If the user chooses to find the best fit, then the program will use both the power and exponential models to find the best fit.
  Hint: the program must find the constants of each model and then calculate the sum of the square of the residuals and determine the best model based on the value of each model.

- The program must show the results of each model and state the best model that fits the data.

- Second menu: will ask the user if they wish to extrapolate using the best fit model. If the user chooses to extrapolate, the program will prompt the user to enter a value to which they would like to extrapolate. The program will show the extrapolated value.

- The sequence of your program is illustrated below:

```
MENU
 1. Best Fit
 2. Quit
```

If the user selects 1, they should see this:

```
Please enter the name of the file to open:
```

The user will enter "`rocket.xslx`", at which point your code will load the data using the file name provided by the user. If the user selects 2, the program exists. If the user enters a wrong file name, then the program should show this message:

```
File does not exist, please enter the name of the file to
open:
```

Once loaded, view the data frame, i.e., `rocket_data`. Then, show the results of both fittings, the power and exponential models as below. Please note that the program should show the values of all constants and the Sr for each equation.

```
Power Model:
d = a * t^b
Sr = …

Exponential Model:
D = a * e^(b*t)
Sr = …

The best fit model is … model.
```

Once the best fit model is found, the user will be prompted with the second menu as follows:

```
MENU
 1. Extrapolation
 2. Main Menu
```

If the user selects 2, go back one menu. If the user selects 1, the code will ask the user what time they would like to extrapolate to:

```
Please enter the time to extrapolate to:
```

Calculate the estimated travelled distance and print the result.

- Plot the original data given in the excel sheet along with the best-fit function on the same graph. You must use the right titles for the graph, x-axis (Time-sec) and y-axis (Distance-meter).

- Finally, save the plot as `best_fit.pdf` in the current directory.