linear regression least-squares method

Due Time: 11:50 pm, 15 March 2021

Earnings: 8% of your final grade

NOTE: Plan to finish a few days early to avoid last minute hardware/software holdups for which no allowance is given.

NOTE: The code in this assignment must be your own work. It must not be code taken from another student or written for you by someone else, even if you give a reference to the person you got it from (attribution); if it is not entirely your own work it will be treated as plagiarism and given a fail mark, or less.

Purpose: Fit data using non-linear regression least-squares method for an exponential function.

Discussion: A hospital administrator wished to develop a regression model for predicting the degree of long-term recovery after discharge from the hospital for severely injured patients. The predictor variable to be utilized is number of days of hospitalization (X), and the response variable is a prognostic index for long-term recovery (Y), with large values of the index reflecting a good prognosis. Data for 15 patients were studied and are presented in a file Related earlier studies reported in the literature found the relationship between the predictor variable and the response variable to be **exponential.** Hence, it was decided to investigate the appropriateness of the two-parameter nonlinear exponential regression mode.

Days	Prognostic_index
2	54
5	50
7	45
10	37
14	35
19	25
26	20
31	16
34	18
38	13
45	8
52	11
53	8
60	4
65	6

For the data in the file, the function has the form $N = ae^{bx}$ where a and b are constants that are determined from the fit. Until the user wishes to quit the application should do the following:

- Read data from a file
- Print the data
- Print report summary of the data (mean, median, range, mood, and standard Deviation)
- Do an exponential fit and print the regression equation
- Compute how accurate your exponential fit (Standard Error)
- Offer an interpolation/extrapolation of both the prognostic index.

The exponential data has to be transformed to have a linear relation. Then find the value of a and b using the equations given in your lecture's slides.

Offer the user the option of interpolating / extrapolating the data to find what the prognostic index will be in other days.

What to Submit: Set up an empty project in Visual Studio 2019 with the name ass2, add a new source code file ass2.cpp\c to the project and write your code in it to implement the application, as described above.

Then on Brightspace in the Assignment Submission folder submit your ass2.cpp\c file.

Don't submit the project, submit only .c or .cpp file.

There is a late penalty of 25% per day - even one minute is counted late.

You may lose 60% or more if:

- The output is wrong
- Your program won't build in Visual Studio 2019
- Your program crashes in normal operation
- I can't build it because you submitted the wrong files or the files are missing, even if it's an honest mistake – this gets 100% deduction.

Don't send me the file as an email attachment – it will get 0.

It is also vital that you should follow the **Submission Standard** in your source file so it can be identified as yours.

Make sure you have submitted the correct file. If I cannot build it because the file is wrong even if it's an honest mistake, you get 0.

Example Output

Example output is given below. **Yours should be the same**.

Note that your assignment might be tested with different interpolation / extrapolation parameters than those shown.

```
LEAST_SQUARES LINEAR REGRESSION

MENU
 1. Exponential Fit
 2. Quit
1
Please enter the name of the file to open: data.txt
Days         Prognostic_index
2            54
5            50
7            45
10           37
14           35
19           25
26           20
31           16
34           18
38           13
45           8
52           11
53           8
60           4
65           6
There are 15 records.

Data summary (Prognostic index):
Mean =???
Median=???
Range=???
Mode=???
Standard Deviation=???

Linear Regression Fit:  Prognostic_index  = ???*exp -???*days
Stander Error=???

MENU
 1. Extrapolation
 2. Main Menu
 1
Please enter the days to extrapolate to: 33
days = 33
Prognostic_index = 16.2

MENU
 1. Extrapolation
 2. Main Menu
 1
Please enter the days to extrapolate to: 73
days = 73
Prognostic_index = 3.54

MENU
 1. Extrapolation
 2. Main Menu
 2

LEAST_SQUARES LINEAR REGRESSION
MENU
 1. Exponential Fit
 2. Quit
```