

Due Date: 23rd September 2021

Instructions:

1. Answer ALL questions in the spaces allocated.
2. In this assignment, you are required to show all your working.
3. Your answers must be written in the spaces provided. You can adjust the spaces allocated for the answers if you need more space. You can type your answers if you wish.
4. The lecturer maintains the right to call students in individually and ask them questions on the assignments. This may result in an adjustment of the final assignment grade.
5. Upload (i) Your R code (ii) Your Data and (3) A softcopy of your assignment on myelearning as a pdf. In Dropbox 1. DO NOT SUBMIT AS A SINGLE ZIP FILE with all the documents.

1. QUESTION 1 (OPTIMIZATION – function with two variables)

- (a) Do some reading on how you can find the maximum and minimum of a function $f(x,y)$. You may come across terms like saddles point, partial derivatives etc. After you have read that, find the maximum, minimum and saddle points (if any) exists for the following function:

$$f(x,y) = e^{-\frac{1}{3}x^2 + x + y^3}$$

[10 marks]

- (b) Use R to plot a the function $f(x,y)$. Use the following range $-2 < x < 2$ and $-2 < y < 2$.

(i) Rcode

[2 marks]

(ii) Plot

[2 marks]

- (c) Use the optim function in R to confirm your results in (a).

(i) R code & Output.

[2 marks]

2. Find the two parameter Weibull distribution in Wikipedia.

- (a) Write some R code to plot this distribution for the parameters $b = 5$ and $\eta = 1$.

(i) R code

[1 mark]

(ii) Paste the plot here

[1 mark]

- (iii) Use the newton's method in the course handout and write suitable functions for f , df and $df2$. Then generate 1,000 variates from a Weibull with $b = 5$ and $\eta = 1$ and check how well newton's method is able to recover the estimates of the parameters. You will follow the following steps to get this done:

A. code for generating the 1,000 variates from a Weibull with $b = 5$ and $\eta = 1$. Use `set.seed(1123)` to ensure everyone has the same data.

[1 mark]

B. Find the score vector (column of first derivatives).

[4 marks]

C. Write an R function for the first derivatives (df) which you will use in the Newton Raphson method.

[4 marks]

D. Find the hessian matrix (matrix of second derivatives which we call $df2$).

[4 marks]

E. Write an R function for the hessian matrix ($df2$) which you will use in the newton Raphson method.

[4 marks]

F. Apply the Newton Raphson Method in R and give the output. Comment on your results.

[4 marks]