Homework 2 on Newton's methods

Leave your name and uni here

Due: 03/18/2020, Wednesday, by 1pm

Problem 1

Design an optmization algorithm to find the minimum of the continuously differentiable function $f(x) = -e^{-1}\sin(x)$ on the closed interval $[0, 1.5]$. Write out your algorithm and implement it into **R**.

Answer: your answer starts here...

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#R codes:
```

Problem 2

The Poisson distribution is often used to model "count" data — e.g., the number of events in a given time period.
The Poisson regression model states that

$$Y_i \sim \text{Poisson}(\lambda_i),$$

where

$$\log \lambda_i = \alpha + \beta x_i$$

for some explanatory variable x_i. The question is how to estimate α and β given a set of independent data $(x_1, Y_1), (x_2, Y_2), \ldots, (x_n, Y_n)$.

1. Modify the Newton-Raphson function from the class notes to include a step-halving step.
2. Further modify this function to ensure that the direction of the step is an ascent direction. (If it is not, the program should take appropriate action.)
3. Write code to apply the resulting modified Newton-Raphson function to compute maximum likelihood estimates for α and β in the Poisson regression setting.

The Poisson distribution is given by

$$P(Y = y) = \frac{\lambda^y e^{-\lambda}}{y!}$$

for $\lambda > 0$.

Answer: your answer starts here...

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#R codes:
```

problem 3

Consider the ABO blood type data, where you have $N_{\text{obs}} = (N_A, N_B, N_O, N_{AB}) = (26, 27, 42, 7)$.

- design an EM algorithm to estimate the allele frequencies, P_A, P_B and P_O; and
- Implement your algorithms in R, and present your results..

Answer: your answer starts here...

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#R codes:
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