Assignment 2 – Classification

For Students Taking Machine Learning and Intelligent Data Analysis

Instructions for submission:

- This assignment should take 3-6 hours to complete.
- Submit one pdf file containing all your answers.
- The pdf file must clearly state which question is being answered.
- You may also submit a Jupyter notebook to support your answer to Question 1.

1 Gradient Descent (3 marks)

Carefully read the code provided in the Jupyter notebook *build-logistic-regression-model.ipynb* to work out what it is doing. Then, run the statement below to produce a Logistic Regression model for a problem where input variables can assume values in $[0, 1]$:

```
gradientDescent([[1,0.3,0.1],[1,0.3,0.2],[1,0.6,0.7],
                 [1,0.8,0.2]], [0,0,1,1], 5, 0.1, 1000)
```

- Is the resulting model appropriate for the task being learned? **Justify** your answer.
- Discuss one positive **and** one negative point regarding the choice of arguments in the Python statement above in the context of the problem being solved. Your discussion should be supported by evidence whenever possible.

Instructions:

- It is part of the question to think about what evidence you could provide to support your discussion.

- You may add additional functions or lines of code to the Jupyter notebook to gather evidence to help you with answering this question.
- If you do so, please submit the modified Jupyter notebook as part of your assignment, with Python comments explicitly showing which lines of code or functions you have added.
- You must not use any external libraries, except for numpy, matplotlib, math and sys.

2 Newton-Raphson Weight Update Rule (3 marks)

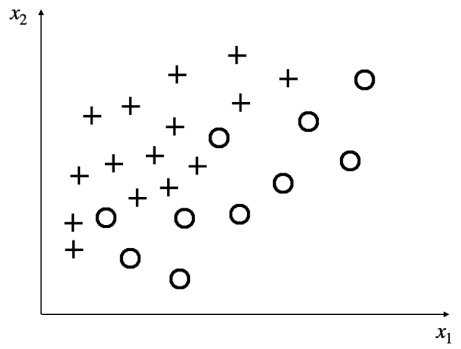
Consider a problem where the following function is to be minimised:

$$E(x) = x^4 - 5x - 3.$$

Would the iterative application of the Newton-Raphson rule be likely to work well to find the optimum value of x for this problem? **Justify** your answer.

3 Logistic Regression's Decision Boundary (4 marks)

Consider a problem with two input variables whose training examples are illustrated in the two-dimensional input space below, where circles represent examples of class 0 and crosses represent examples of class 1:



- Draw a line to represent where you believe that the decision boundary of a Logistic Regression model trained without regularisation will likely be at.
- **Explain in detail** why you believe that the decision boundary will be at this location.

Instructions: there is a figure attached to this assignment, so that you can draw the line and insert it in the pdf file with your answers.