Lab 2 report

Simon Jorstedt & Siddhesh Sreedar

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Question 1

We consider the function

$$g(x, y) = -x^2 - x^2y^2 - 2xy + 2x + 2$$

.

The gradient to g is

$$\nabla g(x, y) = (-2x - 2y^2x - 2y + 2, -2x^2y - 2x)$$

.

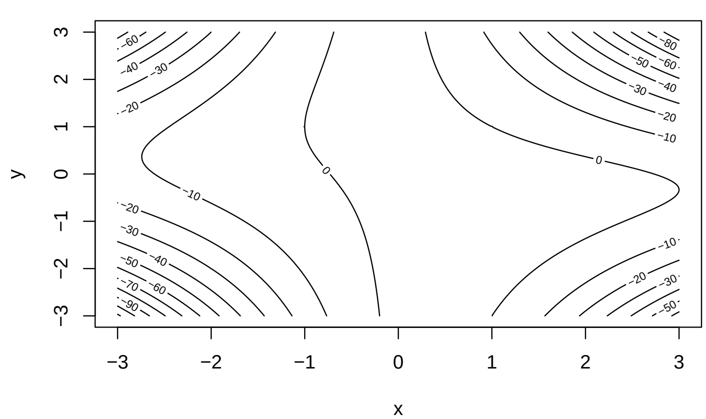
The Hessian matrix corresponding to g is

$$H_g = \begin{bmatrix} -2 - 2y^2 & -4xy - 2 \\ -4xy - 2 & -2x^2 \end{bmatrix}$$

.

See the Appendix for the R implementation of these functions. We will now proceed to plot a contour plot of g in the region $x, y \in [-3, 3]$, with the precision of a square with side 0.01. See Figure 1. We are interested in finding local maximums of g. To achieve this, we will implement the Newton method in a code chunk which can be found in the Appendix.

Fig 1. Contour plot of g(x,y)



When the Newton method is run on the starting points $(2, 0), (-1, -2), (0, 1)$ and $(0.5, 1)$, the following results are obtained.

```
## ---------------------------------------
## Local extrema found: g(1, -1) = 4
## Gradient(1, -1) = (0, 0)
## Hessian(1, -1) =
##      [,1] [,2]
## [1,]   -4    2
## [2,]    2   -2
```

```
## ---------------------------------------
## Local extrema found: g(0, 1) = 2
## Gradient(0, 1) = (0, 0)
## Hessian(0, 1) =
##      [,1] [,2]
## [1,]   -4   -2
## [2,]   -2    0
```

```
## ---------------------------------------
## Local extrema found: g(0, 1) = 2
## Gradient(0, 1) = (0, 0)
## Hessian(0, 1) =
##      [,1] [,2]
## [1,]   -4   -2
## [2,]   -2    0
```

```
## ---------------------------------------
## Local extrema found: g(0, 1) = 2
## Gradient(0, 1) = (0, 0)
## Hessian(0, 1) =
##      [,1] [,2]
## [1,]   -4   -2
## [2,]   -2    0
```

Question 2

Fit logistic regression

Appendix

Old code