

# NUMERICAL OPTIMISATION

## ASSIGNMENT 0: EXAMPLE

MARTA BETCKE  
KIKO RUL-LAN

### EXERCISE 1.

- (a) Write a Matlab function that implements the Rosenbrock function

$$f(x, y) = 100(y - x^2)^2 + (1 - x)^2.$$

Be careful to implement a function that can be evaluated at many points simultaneously.

*Submit your implementation via Cody Coursework.*

- (b) Create a two dimensional grid using Matlab's command `meshgrid`. Plot  $f$  using your implemented Matlab's function on the grid. Check out the following functions: `surf` (use option 'EdgeColor' = 'none' when using many grid points), `surfc`, `contour`, `contourf` to highlight the minimum.

*Submit your solution via Turnitin.*

- (c) Calculate the gradient  $\nabla f$  and the Hessian  $\nabla^2 f$

*Submit your solution via Turnitin.*

- (d) Find the minimiser  $x^*$  of the function  $f$ . Show that

$$\nabla^2 f(x^*)$$

is positive definite.

*Submit your solution via Turnitin.*

- (e) Compute the gradient  $\nabla f$  and the Hessian  $\nabla^2 f$  numerically using finite differences. Check out the functions `gradient`, `diff`, and implement finite differences as a matrix multiplication.

*Submit your solution via Turnitin.*

Remark. The submission to Turnitin should not be longer than 2 pages. Avoid submitting more code than needed (if any) and focus on explaining your results.