Computer Assignment 2: MATH 340, Fall 2013

Due Wednesday, October 30

You may work alone or in teams of two people. Each team must submit a single printed solution. Solutions must contain your *relevant* MATLAB input and output (do not include commands that didn't work), and text that indicates what your commands are doing and interprets your results. (You may find one of the following commands useful in preparing your solutions: `publish`, `notebook`, or `diary`; see MATLAB's online help for details.) Organization and clarity count.

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Let $f\begin{pmatrix} x \\ y \end{pmatrix} = x^2 + y^4 + 2.1\sin(2(x-y))$. Find decimal approximations to the critical points of f (points where the derivative of f is zero) and classify each as a local maximum, local minimum, or neither. Also compute the value of f at each critical point, and determine whether any of these points is a global maximum or a global minimum. In order to get an idea of how many critical points there are and to find appropriate points to use as initial guesses for Newton's method, it may be helpful to graph the function on appropriate ranges with both `ezmesh` and `ezcontour`.

You can classify the critical points by hand, but here are a couple hints for using MATLAB for this part. The quadratic form $Q_{f,\mathbf{a}}$ associated with f at the critical point $\mathbf{a}$ is positive definite if and only if the Hessian matrix H of f ad $\mathbf{a}$ is (and the same for negative definite). You can compute a Hessian in MATLAB by applying `jacobian` twice. You can determine whether a symmetric matrix `A` in MATLAB is positive definite using `chol`; type `[~,p] = chol(A)` and the output `p` will be `0` if `A` *is* positive definite and nonzero if `A` *is not* positive definite. (As with all classification problems in linear algebra, the algorithm can be fooled by round-off error, especially for large matrices. But at least for small matrices, the results should be reliable.)