Optimization Bonus Maple Assignment – Spring 2008

You can gain up to 5 extra points towards your Maple grade by completing the assignment below. A rough background information has been created (linked on the class website). Personal data has also been generated and posted on the class website.

You work in the pharmaceuticals division of Wayne Industries. You are working with a compound which is made up of two chemicals, say X and Y. The effectiveness of this compound depends on the amount of each chemical present, according to some function $f(x, y)$, where x is the percentage of chemical X and y is the percentage of chemical Y. You want to maximize the effectiveness of the compound based on this effectiveness function. Of course, since these percentages must add up to 100, we have the constraint that $x + y = 100$.

Use Maple to complete the following. Include all the commands that helped you get your answer, but delete (using Ctrl+Del) any non-functioning lines of code.

(1) Plot the effectiveness function $z = f(x, y)$ and the constraint $x+y = 100$ together on one three-dimensional plot. If you wish, you may also plot the intersection of these two surfaces using a spacecurve.
(2) Use the method of Lagrange Multipliers to find critical points for $f(x, y)$ with the constraint $x + y = 100$. Let Maple do all the differentiation and equation solving for you.
(3) Plot the critical point or points $(x, y, f(x, y))$ from step 2 with the plot from step 1.
(4) Evaluate $f(x, y)$ at the critical points at step 2. What mixture would you recommend to maximize effectiveness? Write a short paragraph explaining your conclusions.