

## CS164 LESSON 10.1 - PRECLASS WORK EXERCISES

Complete the exercise below and be prepared to paste in your answer during class.

In this exercise, we will show how the KKT conditions can be used directly to find a globally optimal solutions to a simple optimization problem. Consider a problem of the form

$$\max_{x,y} f(x,y) = xy$$

subject to:

$$x + y^2 \leq 2$$

$$x, y \geq 0$$

- (1) The cost function in this case is continuous and bounded over a compact region, so that we know that there exists a globally optimal solution. Even though the objective is not strictly concave, the KKT conditions can still be applied in this case, but are only necessary and not sufficient for a global optimum. Hence, there may be multiple points that satisfy all of the KKT conditions. Write out the KKT conditions for this function by defining an appropriate number of Lagrange multipliers.
- (2) Try various combinations of the multipliers being nonzero and solve for the corresponding  $x$  and  $y$ . **HINT:** all constraints cannot be active simultaneously.
- (3) State the globally optimal solution to the optimization problem by checking the objective function value at all of the points that satisfy the KKT conditions.