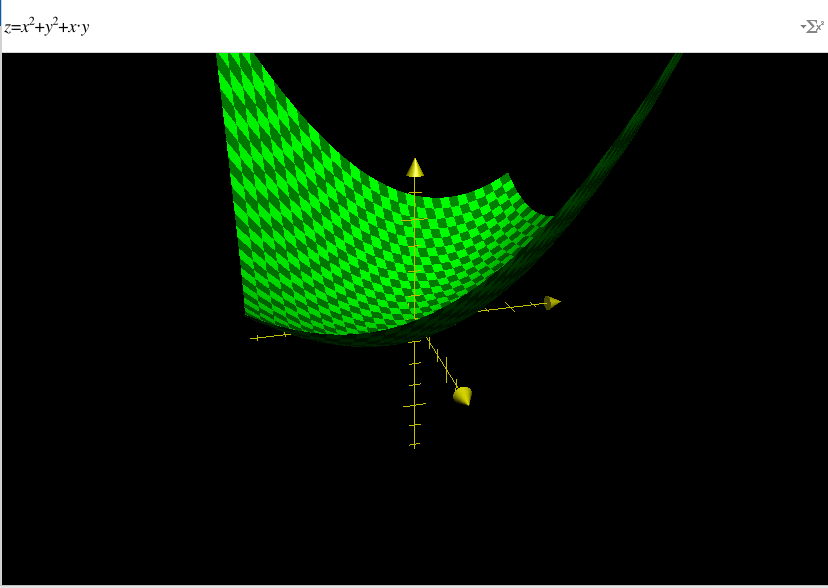
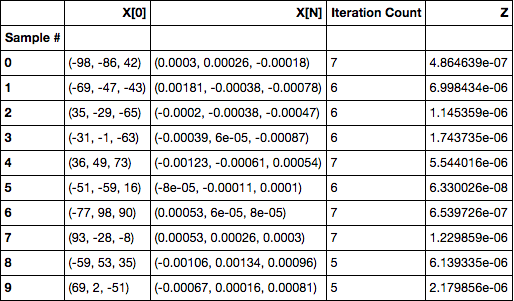
**IMSE 982 Final Project**

**Blake Conrad**

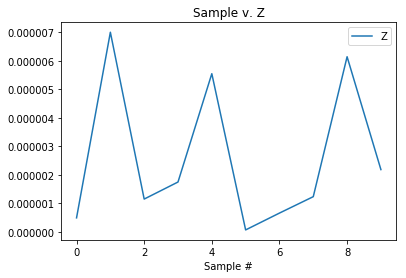
Problem 1: Quasi-convex function: Hyper-Bowl Function;

*If we held z as a constant, we can try to visualize what this function looks like in the images below:*



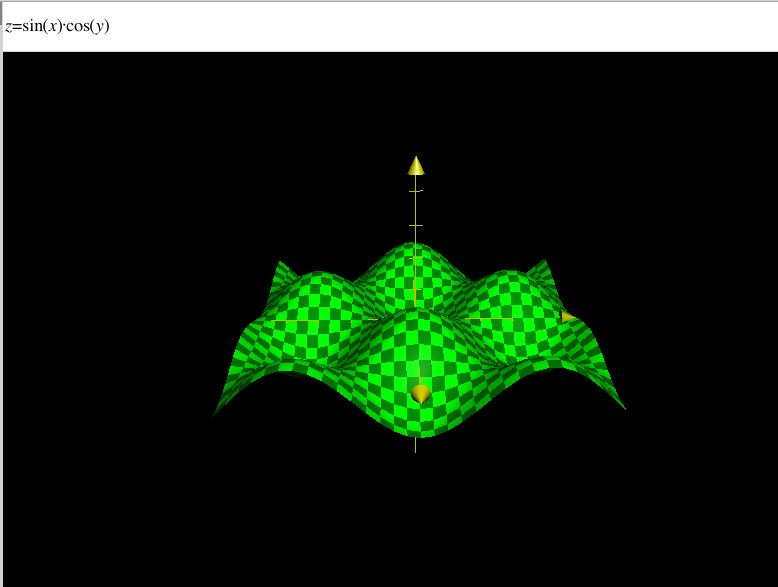


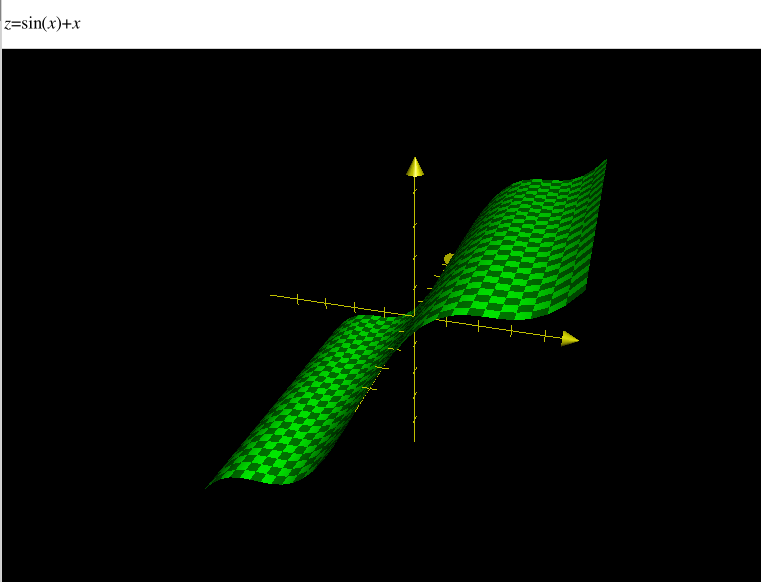
The z values are beyond the billionths, hence these are sufficiently close to one another illustrating a global optimal from our convex function f.

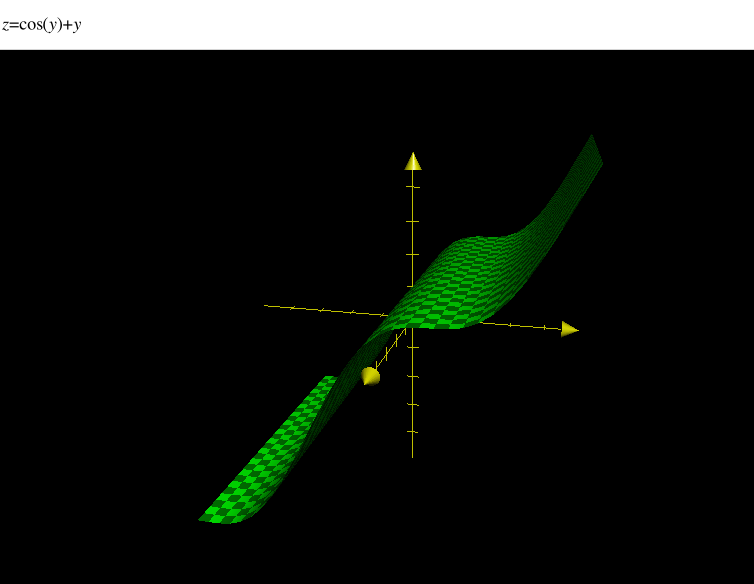


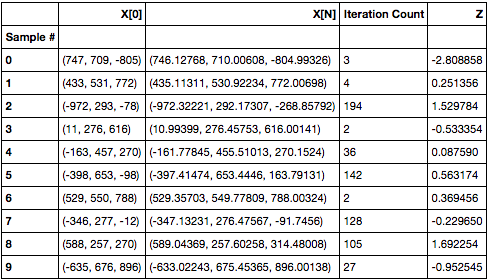
Problem 2: Non Convex Function (Multiple KKT Points): Periodic Wave Function;

If we held each variable constant, we can try to visualize what this function will look like as just f(x,y,1), f(x,0,z), and f(0,y,z).

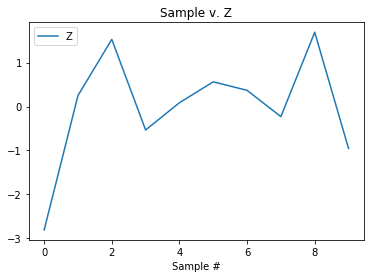








We see optimal solutions everywhere from -3 to 1 and in between. Hence, we are dealing with a multiple KKT points and have a sample of 10 different local minima on f.



Problem 3: Constrained Quasi-convex function: Hyper-Bowl Function;

subject to:

The Penalty Function will be defined as

subject to:

Clearly the point we should converge within the hyper-sphere g1 hyperplane and on the hyperplane h1. Geometrically, we would try to think about this as a hyperbola contained within a sphere with a line drawn through it. Clearly, we would expect the point where they all intersect to be 1 location and optimal. After finding where the paraboloid f, hypersphere g1, and hyperplane h1 intersect, we obtain the point . This is indeed the only KKT point, so we would expect our algorithm to find this as well using the penalty method with a sufficiently large .