Dupuy — Math 121 — Homework 06

Instructions Remember to show all of your work to get credit. Please do this assignment on a separate sheet of paper. Remember to use your words.

1. Three alleles (alternative versions of a gene) A, B and O determine the four blood types A (AA or AO), B (BB or BO), O (OO) and AB. The Hardy-Weinberg Law states that the proportion of individuals in a population who carry two different alleles is

$$P = 2pq + 2pr + 2rq,$$

   where p, q and r are the proportions of A, B and O in the population. Use the fact that $p+q+r = 1$ to show that P is at most $2/3$. (Note that $p, q, r \geq 0$)

2. Optimize the function $f(x, y, z, t) = z + y + z + t$ subject to the constraint $x^2 + y^2 + z^2 + t^2 = 1$.

3. Optimize the function $f(x, y, z) = x^2 + y^2 + z^2$ subject to the constraints $x - y = 1$ and $y^2 - z^2 = 1$.