

Math-71 Sections 02, 03, 60

Homework #9

Due: 11/06/2019 1:15pm

Reading

Read sections 13.3–13.6

Problem

You work for a large conglomerate of 100 associated companies. In order to avoid antitrust issues with the DOJ, you need to divide the 100 companies into 4 different groups such that:

1. Companies within the same group cannot do business with each other.
2. Companies in different groups can do business with each other.

What organization of the 100 companies into the 4 groups maximizes the number of business opportunities?

- a) Start by labeling the groups X, Y, Z , and W . Let x = the number of companies assigned to group X and so on for the other groups. Construct an equation in x for the number of business opportunities for a company in group X — i.e., how many companies can that company do business with?
- b) Now build an equation in x for the total number of business opportunities for all companies in group X .
- c) Do likewise for the remaining groups and construct a function $f(x, y, z, w)$ that gives the total number of business opportunities across all the groups.
- d) What is the constraint on x, y, z , and w ?
- e) Introduce a Lagrange multiplier λ and determine $f_x = \lambda g_x$, where g is the function constructed from the above constraint.
- f) Do likewise for f_y, f_z , and f_w , and combine them with the constraint so that you have 5 equations in 5 unknowns.
- g) Use substitution to determine a value for λ .
- h) Substitute the value for λ into the other equations to determine the optimal distribution of companies into the 4 groups.