

CE 215 – Optimization Homework

Create both an Excel spreadsheet and a Mathcad sheet that solve the following optimization problem.

Development Project

- You plan to develop a ten-acre site.
- You plan to complete the project in five years.

The development will include a mix of low-income and middle-income housing.

- Low-income housing units cost \$60,000 each to build, including labor.
- Low-income housing density is 20 units/acre.
- Middle-income housing units cost \$80,000 each to build, including labor.
- Middle-income housing density is 12 units/acre.

- Zoning requirements limit the development to no more than 155 units on the site.
- Zoning requirements also require a minimum number and proportion of low-income units. Specifically there must be at least thirty-five low-income units *plus* half the number of middle-income units, i.e., $35 + M/2$, where M is the number middle-income units.

- The per-unit costs cited above assume a stable labor market. In order to avoid raising labor costs, you assume that sixty skilled craftsmen are available to work on the project for the duration of the five-year project.
- Low-income units require two person-years to construct
- Middle-income units require two and a half person-years to construct.

A market analysis indicates that you expect to be able to sell a maximum of:

- One hundred low-income units.
- Seventy-five middle-income units.

You expect to sell the units at the following prices:

- Low-income units: \$100,000
- Middle-income units: \$180,000

Objective:

Determine how many low- and middle-income units to build in order to maximize profits.

Hints:

- Each of the bulleted items above is related to a constraint or objective for the project.
- Note that the profit mentioned above is the difference between the selling price and the building cost.
- You can write all the constraints in terms of the number of low- and middle-income units.