PLANNING OF THE MEXICAN STEEL PRODUCTION

EXCERCISES

Below follows some exercises which should be solved for the project. Note that import and exports is allowed only in the questions 2(a) and 2(b) and that all questions should be solved independently

Everyone should do the questions 1, 2, 3(a), 3(b) and 3(g). The questions 3(c)–(f) is done by the following groups: (c) is done by groups whose group number ends with a 0,1, or 2 , (d) by groups with numbers ending with 3, 4 of 5, (e) by numbers ending with 6 or 7, and (f) by groups ending with 8 or 9.

1. Give an optimal solution value to the problem, and describe the solution, that is which mines supply which plants, and which plants supply which cities.
2. Answer the following questions: Which mills and mines has reached their maximum capacity. Which process-step is the weakest link in the mills operating at maximum capacity?. Remember that some mills have parallel processes, such as plate and pipe production, and the total production may increase although some processes are running at maximum capacity. Find out how much we would gain from a marginal improvement of these limiting capacities. This is the highest price we are ready to pay to expand the capacity. Remember that all processes are not present at all mills, and we may only expand existing processes, that is processes with a maximum capacity in excess of 0.
3. (a) If the country wish to minimize the cost of supplying the domestic demand minus the gains from exporting, at which price does it start to pay off to export products? Find this price, let the price of exports be this price + 1 peso per ton and find the level of exports at this price. Note: there is a constraint limiting the total amount of exports. By using the dual variable of this constraint and thinking for a while, you may avoid trial and error.

   (b) If the import price is low, it may pay off to import the goods instead of producing it locally. Find the price at which it starts to pay off to import goods, and set the import price 1 peso below this price. Find out how much we would import at this price. The tip from the question above applies here too.

   (c) Assume that the price of energy is increased by a factor 10. How does the solution change? Which mills increase/decrease production? How does the transportation pattern change.

   (d) Assuming that the proportional cost of transporting raw materials from all mills is increased by a factor 3. How does the solution change? Which mills increase/decrease production? How does the transportation pattern change.

   (e) Assuming that the distance between Penacol and Ahmsa is decreased by 1,200km (trough building a tunnel). How does the solution change? Which mills increase/decrease production? How does the transportation pattern change.

   (f) What is the gain from investing in new technology? Assume that we get a loan from the IMF to modernize the mill in Ahmsa by building a facility for reducing ore to sponge iron, and and electro oven, both limited to 0.5Mton output. How does the solution change? Which mills increase/decrease production? How does the transportation pattern change. Note that the old processes of Ahmsa are still present.

   (g) Assume that all processes in the mills (including the currently not present) may be expanded at a price of b_{ij} Mpesos per Mton increased capacity of process i in mill j. How should the model change to accommodate this possibility? Provide any changed/extra constraints in your answer.