

Practice Problem Set 5

Notes: Please note that the questions are based on the material in Lectures 7-10. There are five questions in this practice problem set. You do not need to submit this problem set; this is only for your practice; the solutions to the problems will be posted on Canvas after the deadline for HW 4, i.e., Nov 27.

Question 1: Use the Lagrangean method to find the positive values of x and y which maximize

$$\frac{2y}{y+2} + \frac{x}{x+1}$$

subject to the constraint $x + y = 120$.

Question 2: For which value of c is the following system of equations consistent?

$$x_1 + x_2 + x_3 = 2$$

$$2x_1 + x_2 + 2x_3 = 5$$

$$4x_1 + 3x_2 + 4x_3 = c$$

Question 3: Find the inverse of the matrix

$$A = \begin{pmatrix} 1 & 2 & 4 \\ 1 & 3 & 6 \\ -1 & 0 & 1 \end{pmatrix}$$

Question 4: Suppose that the numbers x_1 and x_2 satisfy the equations

$$x_1 - 2x_2 = 3$$

$$3x_1 + 5x_2 = 20$$

Find x_1 and x_2 using Cramer's rule.

Question 5: An economy has four industries: coal, iron, electricity, and railways. To produce \$1 of coal requires \$0.10 worth of iron, \$0.20 of electricity and \$0.50 rail costs for transportation. To produce \$1 of iron requires \$0.60 worth of coal for fuel, \$0.01 of electricity and \$0.20 for transport. To produce \$1 of electricity requires \$0.50 worth of coal for fuel,

\$0.02 of electricity for the auxiliary equipment, and \$0.01 for transport. To provide \$1 worth of transport, the railway requires \$0.50 coal for fuel, \$0.20 iron, and \$0.25 electricity. Each week, the external demand for coal is \$8000, the external demand for iron is \$1000, the external demand for electricity is \$4000, and the external demand for the railway is \$6000. Write down the equation which determines the production schedule for these industries.