Tutorial 2 - Systems of Linear Equations

COMP1046 - Maths for Computer Scientists

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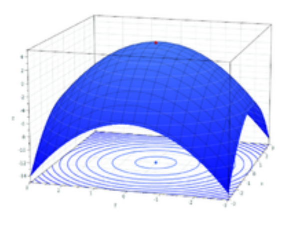

Exercise

For these questions, consider Rouchè-Capelli Theorem and the cases for different systems of linear equations in Lecture 5.

Consider the system of linear equations for variables x_1, x_2, x_3, x_4 represented by this complete matrix:

$$\mathbf{B}^{\mathbf{c}} = \left(\begin{array}{cccr|r} 2 & 1 & 0 & 1 & 1 \\ 0 & 2 & 1 & -1 & 0 \\ 0 & 3 & 1 & 0 & -1 \\ 1 & 1 & -1 & 0 & 0 \end{array} \right).$$

1. Use Cramer's Method to compute solutions for just x_1 and x_2. Show your working.
   Hint: Be strategic in your choice of computing determinants.

Exercise

2. Which case of system of linear equations does $\mathbf{B}^c$ represent?
3. Is this system of linear equations compatible or incompatible?

$$\mathbf{C}^c = \left(\begin{array}{cc|c} 1 & 2 & 0 \\ 2 & 4 & 1 \end{array}\right)$$

4. Show that the system of linear equations represented by the following complete matrix is Case 2? Can you point out where the *redundancy* is?

$$\mathbf{D}^c = \left(\begin{array}{rrr|r} 1 & 2 & -2 & -5 \\ 3 & 0 & 1 & 8 \\ 2 & -1 & -1 & 9 \\ -2 & -4 & 4 & 10 \end{array}\right)$$

Exercise

5. Show that the system of linear equations in x_1, x_2, x_3, x_4 represented by the following complete matrix is Case 3? Can you show how x_1 and x_2 can be expressed in terms of x_3 and x_4 hence giving ∞^2 possible solutions?

$$\mathbf{E^c} = \left(\begin{array}{cccc|c} 1 & 2 & 2 & 1 & 0 \\ 1 & 0 & -1 & 0 & 1 \end{array} \right)$$