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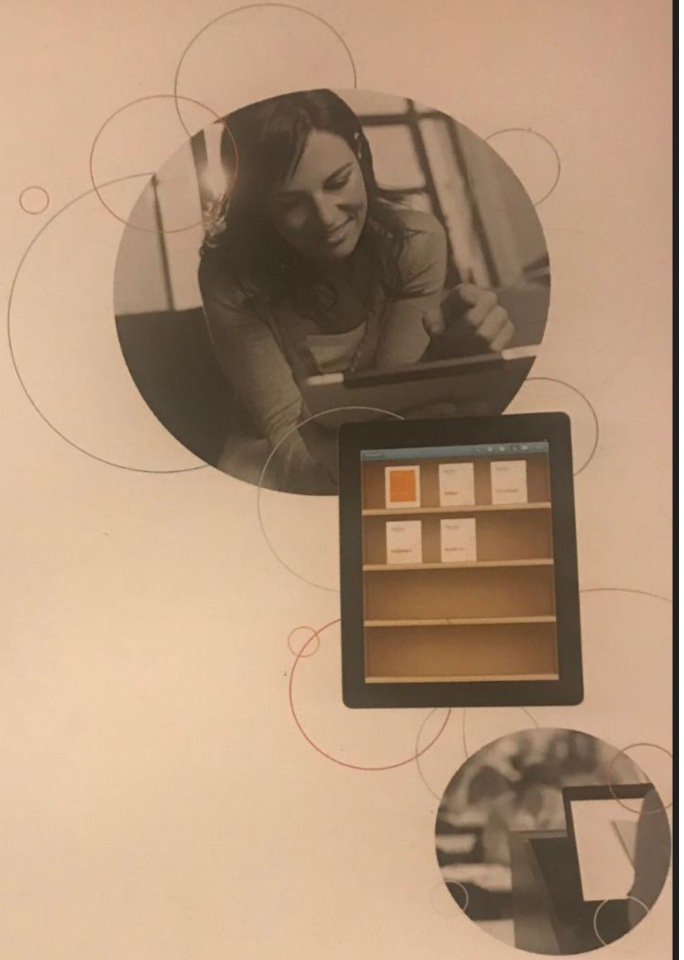

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Chem 510

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Chapter 18: Simultaneous Equations by Gaussian Elimination

Introduction

Gaussian elimination is a mathematical method used to:

a) evaluate determinants

b) triangularize matrices & determinants

c) solve simultaneous equations

Given a determinant A:

$$|A| = \begin{vmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ a_{31} & a_{32} & \cdots & a_{3n} \\ \cdots & \cdots & \cdots & \cdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{vmatrix}$$

The value of the determinant of A can be calculated by expansion by minors across its i^{th} row:

$$|A| = a_{i1}|A_{i1}| + a_{i2}|A_{i2}| + a_{i3}|A_{i3}| + \ldots + a_{in}|A_{in}|$$

where $|A_{ij}| = (-1)^{i+j}\,|M_{ij}|$

Hence, the determinant of a 2 x 2 matrix is given by;

$$|A| = \det\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = a_{11}a_{22} - a_{12}a_{21}$$

while the determinant of a 3 x 3 matrix,

$$|A| = \det\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

is given by

$$|A| = a_{11}a_{22}a_{33} + a_{12}a_{23}a_{31} + a_{13}a_{21}a_{32} - a_{13}a_{22}a_{31} - a_{12}a_{21}a_{33} - a_{11}a_{23}a_{32}$$