# EE5609 Assignment 3

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***Abstract*—This assignment involves finding the determinant of a matrix.**

The python code solution can be downloaded from,

https://github.com/Vaibhav11002/EE5609/blob/master/Assignment_3/Codes/assignment_3.ipynb

## 1 Problem

Prove that,

$$\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2$$

## 2 Solution

$$\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix}$$

$$\xleftrightarrow{R1\leftarrow\frac{R1+R2+R3}{2}} 2\begin{vmatrix} a^2+ab & b^2+bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix}$$

$$\xleftrightarrow{R1\leftarrow R1-R2} 2\begin{vmatrix} 0 & bc & c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix}$$

$$\xleftrightarrow[C3\leftarrow\frac{C3}{c}]{C1\leftarrow\frac{C1}{a};C2\leftarrow\frac{C2}{b}} 2abc\begin{vmatrix} 0 & c & c \\ a+b & b & a \\ b & b+c & c \end{vmatrix}$$

$$\xleftrightarrow{R3\leftarrow R3-R1} 2abc\begin{vmatrix} 0 & c & c \\ a+b & b & a \\ b & b & 0 \end{vmatrix}$$

$$\xleftrightarrow{R2\leftarrow R2-R3} 2abc\begin{vmatrix} 0 & c & c \\ a & 0 & a \\ b & b & 0 \end{vmatrix}$$

$$\xleftrightarrow[R3\leftarrow\frac{R3}{b}]{R1\leftarrow\frac{R1}{c};R2\leftarrow\frac{R2}{a}} 2a^2b^2c^2\begin{vmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{vmatrix} \quad (2.0.1)$$

$$\xleftrightarrow{R1\leftarrow R1+R2-R3} 2a^2b^2c^2\begin{vmatrix} 0 & 0 & 2 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{vmatrix} \quad (2.0.2)$$

$$\xleftrightarrow{R1\leftarrow\frac{R1}{2}} 4a^2b^2c^2\begin{vmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{vmatrix} = 4a^2b^2c^2(1) \quad (2.0.3)$$

$$= 4a^2b^2c^2 \quad (2.0.4)$$