Math 421: **Real matrices**

The matrices arising from real applications are rarely random. Sometimes they are *sparse*, meaning they have relatively few non-zero entries for their size (for example, a 2,000 by 2,000 matrix with only about 2.500 non-zero entries). Sometimes matrices have *block form*, with patterns we'd like to use, and sometimes the uses are correct and sometimes, not.

1. Suppose we have the following matrices:

$$A = \begin{pmatrix} a & b & e & f \\ c & d & g & h \\ 0 & 0 & i & j \\ 0 & 0 & k & l \end{pmatrix} \quad B = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \quad C = \begin{pmatrix} i & j \\ k & l \end{pmatrix}$$

Prove that $\det(A) = \det(B)\det(C)$.

2. Suppose we have the following matrices:

$$A = \begin{pmatrix} a & b & e & f \\ c & d & g & h \\ i & j & m & n \\ k & l & o & p \end{pmatrix} \quad B = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \quad C = \begin{pmatrix} e & f \\ g & h \end{pmatrix} \quad D = \begin{pmatrix} i & j \\ k & l \end{pmatrix} \quad E = \begin{pmatrix} m & n \\ o & p \end{pmatrix}$$

Give an example to show that $\det(A)$ may not be equal to $\det(B)\det(E) - \det(C)\det(D)$.