It is possible to fill a $3 \times 3$ array with the numbers 1, 2, $\ldots$, 9 in such a way that the product of the numbers in the $i$th row equals the product of the numbers in the $i$th column for each $i = 1, 2, 3$. One way to do this is:

\[
\begin{array}{ccc}
5 & 2 & 4 \\
1 & 9 & 6 \\
8 & 3 & 7 \\
\end{array}
\]

Show that, if $n > 8$, it is impossible to fill an $n \times n$ array with the numbers 1, 2, $\ldots$, $n^2$ in such a way that the product of the numbers in the $i$th row equals the product of the numbers in the $i$th column for each $i = 1, 2, \ldots, n$. 