Given two noncommuting matrices, $A$ and $B$, it is well known that $AB$ and $BA$ have the same trace. This extends to cyclic permutations of products of $A$’s and $B$’s. Thus, for example, $AAAAAB, BAAAAA, BBAAAA, AABAAA, AABBA$ and $ABABBA$ all have the same trace. This means that if $A$ and $B$ are fixed matrices then products of four $A$’s and two $B$’s can have 3 possible traces. For $2 \times 2$ matrices $A$ and $B$ we show that there are restrictions on the relative sizes of these traces. For example, if $M_1 = A^4B^2$, $M_2 = A^3BAB$ and $M_3 = A^2BA^2B$ then it is never the case that $\text{Trace}(M_1) > \text{Trace}(M_3) > \text{Trace}(M_2)$. For larger collections of $A$’s and $B$’s, forbidden orders become much more common. In this talk, these and similar results are discussed. (Received September 16, 2014)