It might come as a surprise that there are no $2 \times 2$ real matrices $A$ and $B$ for which $\text{Tr}(A^2B^4) < \text{Tr}(AB^2AB^2) < \text{Tr}(ABAB^3)$. More generally, suppose $x_1 = \text{Tr}(A^2B^2), x_2 = \text{Tr}(ABAB^2), \ldots, x_n = \text{Tr}(ABAB^{n-1}AB^{n-1})$. If $\sigma$ is a permutation of $n$ we may ask if there are matrices $A$ and $B$ for which $x_{\sigma(1)} < x_{\sigma(2)} < \cdots < x_{\sigma(n)}$. It turns out that for most permutations (when $n$ is large), the answer is no. Call a permutation trace order consistent if $2 \times 2$ matrices $A$ and $B$ exist for which $x_{\sigma(1)} < x_{\sigma(2)} < \cdots < x_{\sigma(n)}$. Using elementary properties of the zeros of Chebyshev polynomials of the second kind, an exact count is given for the number of trace order consistent permutations. (Received September 10, 2017)