1135-20-428 **Charles A Matthews*** (cmatthews@se.edu). *The Permutations Project.*

It is well-known that the disjoint cycle decomposition of the permutation $(1\,2\cdots n)^k$ consists of cycles all of the same length $n/\gcd(n,k)$. It has been proven that the disjoint cycle decomposition of the permutation $(1\,2\cdots n_1)^{k_1}\cdots(1\,2\cdots n_g)^{k_g}$ consists of cycles of at most g distinct lengths, but the proof involves the topology of multiple curves on a surface of genus g along with the use of the Euler Characteristic, and no explicit formula for the cycle lengths is known when $g > 1$. Southeastern began a project with faculty and undergraduate students from mathematics and computer science to find explicit formulas for the multiplicities $m_1, m_2, \ldots, m_g$ and the lengths $\ell_1, \ell_2, \ldots \ell_g$ such that the disjoint cycle decomposition of the permutation $(1\,2\cdots n_1)^{k_1}\cdots(1\,2\cdots n_g)^{k_g}$ consists of m_i cycles of length ℓ_i for $1 \leq i \leq g$. This open problem is quickly accessible by undergraduate students at every level, and our students have discovered and proven some new theorems and stated about fifty conjectures still waiting to be proven. Methods have included linear algebra, number theory, graph theory, abstract algebra, programming with Mathematica, and supercomputing. (Received September 01, 2017)