An Eigenvalue Problem for Quantum Computing SELMAN HERSHFIELD, University of Florida — A unitary operator on a quantum spin system of the form, $U = e^{-iH_1}e^{-iH_2}$, is introduced. Here, $H_1$ and $H_2$ are Hermitian and easily diagonalized; however, because the diagonalizing bases for $H_1$ and $H_2$ are quite different, the operator $U$ is strongly interacting. The eigenvalues of $U$ can be used to help factor products prime numbers in a manner similar, but not identical to the Shor algorithm. Indeed even approximate eigenvalues could be useful. Since $U$ is strongly interacting, the practical usefulness of this approach hinges of finding tractable approximations. Toward this end, results of exact diagonalization of $U$ for small systems are compared with the solution of several different approximate schemes.