Fall 2016 Problem 3: Show that every linear map $A : \mathbb{R}^3 \to \mathbb{R}^3$ has both a 1-dimensional invariant subspace and a 2-dimensional invariant subspace.

Fall 2015 Problem 3: What is the smallest possible n for which there is an n by n real matrix M which has both:

(1) the rank of M^2 is smaller than the rank of M,
(2) M leaves infinitely many length one vectors fixed.

Spring 2016 Problem 5 Find all possible Jordan canonical forms for a matrix $A = T((123))$ if T is a two dimensional complex representation of the symmetric group S_3.

Spring 2015 Problem 1: Show that if M is a nondiagonalizable complex matrix and M^n is diagonalizable then det(M)=0.

Fall 2017 Problem 3: Let $M_n(\mathbb{R})$ denote the ring of $n \times n$ matrices over $\mathbb{R}$, and consider a (possibly non-unital) ring homomorphism $f : M_{n+1}(\mathbb{R}) \to M_n(\mathbb{R})$. Can f be nonzero?