Problem Set 5 Writeup

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1 Exercises on transposes, permutations, spaces

Problem 5.1: a) Find a 3 by 3 permutation matrix with $P^4 = I$ (but not $P = I$). b) Find a 4 by 4 permutation P with $P^4 = I$

$$\begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

Problem 5.2: Suppose A is a four-by-four matrix. How many entries can be chosen indepently if A is symmetric? How about if A is skew-symmetric?

Ten entries can be chosen if A is symmetric and 6 entries can be chosen if A is skew symmetric.

Problem 5.3: True or false (check addition or give a counterexample):

a) The symmetric matrices in M (with $A^T = A$) form a subspace.

b) The skew-symmetric matrices in M (with $A^T = A$) form a subspace.

c) The unsymmetric matrices in M (with $A^T \neq A$) form a subspace.

a) True. b) True. c) False due to

$$\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$