# HOMEWORK 11 : HOMOLOGY

**PROBLEM 1**: Let's practice quotients a bit. Let $M^2\mathbb{R}$ be the space of $2\times 2$ matrices with entries in $\mathbb{R}$.

1. Observe that $M^2\mathbb{R}$ is a vector space of dimension 4
2. Let $I$ = subspace spanned by the matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
3. Describe as best you can the quotient vector space $M_2\mathbb{R}/I$

**PROBLEM 2**: Give examples of two spaces which have the same homology, yet are not homeomorphic.

EXTRA CREDIT: same homology, but not homotopic...

**PROBLEM 3**: Compute $H_*(\mathbb{RP}^2; G)$ for $G = \mathbb{Z}_2, \mathbb{R}, \mathbb{Z}$.

**PROBLEM 4**: What is $H_p$ for $p: T^2 \to K^2$ the covering space (2-sheeted cover of torus-to-Klein)? Use $\mathbb{Z}_2$ and $\mathbb{Z}$ coefficients.