Ask me about anything that isn't clear.

The *average* of a vector $x \in \mathbf{R}^n$ is defined as

$$\mathbf{avg}(x) = \frac{x_1 + \cdots + x_n}{n}.$$

Average-preserving linear transformation.
Under what conditions on $A \in \mathbf{R}^{m \times n}$ do we have

$$\mathbf{avg}(Ax) = \mathbf{avg}(x)$$

for all $x \in \mathbf{R}^n$?

Average-reducing linear transformation.
Under what conditions on $A \in \mathbf{R}^{m \times n}$ do we have

$$|\mathbf{avg}(Ax)| \leq |\mathbf{avg}(x)|$$

for all $x \in \mathbf{R}^n$?