ELEC 3035: Quiz on linear algebra, Name (optional):

1. *Functions* Give a formula defining the function whose graph is a straight line passing through $(0,1)$ and $(1,1)$.

2. *Subspaces* Give an example of a subspace in $\mathbb{R}^2$. Describe all subspaces of $\mathbb{R}^2$.

3. *Rank, range, and kernel* What are the rank, range, and kernel of the matrix $A = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$?

   State connections among rank, range, and kernel of a matrix.

4. *Underdetermined system of linear equations* What is the solution set of $\begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} = 1$.

   What is the least norm solution?

5. *Special matrices* Explain in words what the following matrices do when multiplying a column vector and suggest self-explanatory names. (All missing elements are zeros and $\theta \in [0, 2\pi)$.)

$$\begin{bmatrix} 1 & & \\ & \ddots & \\ & & 1 \end{bmatrix}, \quad \begin{bmatrix} & & 1 \\ & \iddots & \\ 1 & & \end{bmatrix}, \quad \begin{bmatrix} 0 & 1 & & \\ & \ddots & \ddots & \\ & & \ddots & 1 \\ & & & 0 \end{bmatrix}, \quad \begin{bmatrix} 0 & 1 & & \\ & \ddots & \ddots & \\ & & \ddots & 1 \\ 1 & & & 0 \end{bmatrix}, \quad \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}.$$