1. True or False?

Suppose $T \in \mathcal{L}(\mathbf{F}^4)$ is not injective and $\dim E(4, T) = 3$. Then T is diagonalizable.

2. True or False?

Suppose $T \in \mathcal{L}(\mathbf{F}^4)$ is not diagonalizable and $\dim \operatorname{range}(T - 3I) = 1$. Then $T + 2I$ is invertible.

3. True or False?

Suppose $T \in \mathcal{L}(\mathbf{F}^3)$ has eigenvalues $3, -4, 17$. Then $\dim \operatorname{range}(T - 3I) = 2$.

4. True or False?

Suppose $\dim V \geq 2$ and

$$U = \{T \in \mathcal{L}(V) : T \text{ is diagonalizable}\}.$$

Then U is a subspace of $\mathcal{L}(V)$.

5. True or False?

If $T \in \mathcal{L}(V)$ and $U = \operatorname{range} T$, then T/U is the zero operator on V/U.

6. True or False?

Suppose $T \in \mathcal{L}(V)$ and U is an invariant subspace. Then every eigenvalue of T/U is also an eigenvalue of T.

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What if V is assumed to be finite dimensional over $\mathbf{C}$?

7. True or False?

There exists an non-invertible operator $T \in \mathcal{L}(V)$ and a basis $v_1, \ldots, v_n$ of V such that $M(T)$ has no zeroes on the diagonal.