1. (8 points) Assume that $V$ is a finite dimensional space. Let $T : V \rightarrow V$ be a linear transformation. Show that the following statements are equivalent:

(a) $T$ is not one-to-one.
(b) $T$ is not onto.
(c) $\det T = 0$.
(d) $T$ has 0 eigenvalue.

2. (2 points) Give an example of two square matrices of the same size that are not similar but have the same characteristic polynomial.