1) G connected algebraic group over $k=\bar{k}$. Show that the set of semisimple elements of $Z(G)$ (center) form a group which is equal to intersection of all maximal tori of G.

2) G connected $k=\bar{k}$. Show that Cartan subgroup (i.e. $C_G(T)^0$ for some maximal torus T) is not contained in the larger nilpotent connected subgroup of G. Give example of other maximal nilpotent connected subgroups of G which are not Cartan.

3) Is it true that $C_G(x)$ for x - semisimple is connected? (If G is connected)

4) Let $\operatorname{char} k=0$. And let u be a unipotent element normalizing Borel subgroup B. Not using $N_G(B)=B$ prove that $u \in B$.

5) Prove that any connected solvable group over $k=\bar{k}$ has a filtration $G \rhd \dots G_i \rhd G_{i+1} \rhd G_N = e$ by subgroups such that G_{i+1} is normal in G_i and $G_i/G_{i+1} \cong k^*$ or k^+. Is it true for $k \neq \bar{k}$?