(1) Let $A$ be a Noetherian ring, $B$ a finitely generated $A$-algebra, $G$ a finite group of $A$-automorphisms of $B$ and $B^G := \{ x \in B \mid f(x) = x \text{ for all } f \in G \}$. Show that $B^G$ is a finitely generated $A$-algebra.

(2) If $n\mathbb{Z} \subset \mathbb{Z}$ is an irreducible ideal, then prove that $n = p^r\mathbb{Z}$ for some prime $p$ and a positive integer $r$.

(3) Find a minimal primary decomposition of $(x^3, x^2y^2, xz^3) \subset k[x, y, z]$. List the isolated and embedded prime ideals.