Problem 1: Kirillov Problem 4.2

Problem 2: Kirillov Problem 4.3

Problem 3: Kirillov Problem 4.9

Problem 4: Kirillov Problem 4.13

Problem 5: Prove the Frobenius reciprocity relation for induced representations (just do for finite groups): when $H$ is a subgroup of $G$, $(\rho, W)$ a representation of $H$, one has an induced representation

$$\text{Ind}_H^G(W)$$

and

$$\text{Hom}_G(V, \text{Ind}_H^G(W)) = \text{Hom}_H(V, W)$$

where $V$ is an arbitrary representation of $G$, and on the right-hand side $V$ refers to its restriction as a representation of $H$. 