Def: Let $(G,\cdot)$ be a group, $H \subseteq G$, if H is itself a group i.e $(H,\cdot)$ is a group, we say that H is a subgroup of G and write as $H \leq G$

if H is a proper subset of G, we say H is a proper subgroup of G and write as: $H < G$.

proposition: Let $\phi \neq H \subseteq G$ then $H \leq G \iff xy^{-1} \in H$ $\forall x, y \in H$.

Example: if G act on Ω then the the stabilizer G_x for $x \in \Omega$ is a subgroup of G i.e $G_x \leq G$.

Remark: $(xy)^{-1} = y^{-1}x^{-1}$ $\forall x, y \in G$.

Def: (Homomorphism): Let G, G' be two groups a function ϕ from G to G' is called a homomorphism if $\phi : G \to G'$, $\phi(gh) = \phi(g)\,\phi(h)$ $\forall g, h \in G$

Remarks: (1) $\phi(e) = e'$ where e and e' are the identities of G, G' respectively.

(2) $\phi(g^{-1}) = \phi(g)^{-1}$ $\forall g \in G$.