1.consider formal power series ring over $\mathbb{C}$, $R = \mathbb{C}[[x]] = \{a_0 + a_1 x + a_2 x^2 + \ldots \mid a_i \in \mathbb{C}\}$

(1)prove:R is Noetherian ring.

(2)find all finitely generated indecomposable $R-$module.

(3)find all double-sided ideals of $M_2(R)$.

(4)find all finitely generated indecomposable left $M_2(R)-$module, and the endomorphism ring of these modules.

2.take abelian group as $Z-$module. consider abelian group $G = (\mathbb{Z}/3\mathbb{Z}) \oplus \mathbb{Z}$.

(1)find all subgroup of G.

(2)find all quotient group of G in the form of direct sum of indecomposable $\mathbb{Z}-$module.

(3)find all subgroup A of G s.t. $\exists$ subgroup B of G, $G = A \oplus B$

(4)describe $\mathrm{Aut}(G)$.

3.construct $\mathbb{C}-$algebra isomorphism concretely:

$$\mathbb{C}[S_3] \xrightarrow{\sim} \mathbb{C} \times \mathbb{C} \times M_2(\mathbb{C})$$