

1 Galois Groups II

Lemma 1.1. *Suppose that $L : K$ is a normal extension with $K \subseteq L \subseteq \overline{K}$. Then for any K -homomorphism $\tau : L \rightarrow \overline{K}$, we have $\tau(L) = L$.*

Lemma 1.2. *For $n \geq 2$, S_n is generated by*

1. *transpositions (ij) ;*
2. *transpositions $(1i)$;*
3. *adjacent transpositions $(12), (23), \dots, (n-1, n)$;*
4. *(12) and $(12 \dots n)$;*
5. *(12) and $(23 \dots n)$;*
6. *(ij) and $(i \dots i_p)$ where p is prime.*

Lemma 1.3. *Let $(i_1 \dots i_k) \in S_n$. Then for all $\sigma \in S_n$, one has $\sigma(i_1 \dots i_k)\sigma^{-1} = (\sigma(i_1) \dots \sigma(i_k))$.*

Note: $|Gal_K(f)| = [L : K]$ where $L : K$ is a splitting field extension for f .