1. Finite dimensional Lie algebra

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The set $\{\alpha, -\alpha\}$ is called the roots of $sl_2(\mathbb{C})$ and the \mathbb{Z} -module $Q = \mathbb{Z}\alpha$ is called the root lattice.

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$$\Phi = \{ \alpha \in H^* \setminus \{ \mathbf{0} \} | L_\alpha \neq \mathbf{0} \}.$$

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- 3. $\alpha \in \Phi$ implies $-\alpha \in \Phi$. Let $h_{\alpha} = [e^{\alpha}, e^{-\alpha}]$. Then span $\{h_{\alpha}, e^{\alpha}, e^{-\alpha}\} \cong sl_2(\mathbb{C})$.

Let $Q = \operatorname{span}_{\mathbb{Z}} \{ \Phi \}$ be the root lattice

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(They are Combinatorial objects!!!)

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The roots of $\tilde{\mathfrak{g}}$ are given by

$$lpha + nd, \qquad lpha ext{ is a root of } \mathfrak{g}, \ n \in \mathbb{Z},$$

 $nd, \qquad n \in \mathbb{Z} \setminus \{0\}$

Vertex representations of affine Kac Moody algebra

(Lepowsky-Wilson (1978), Frenkel-Kac (1980))

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Glue Lattice: Constructing Lattices using codes Let L be an even lattice

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Example: $L = A_1 = \mathbb{Z}\alpha$ such that $\langle \alpha, \alpha \rangle = 2$. Then $\mathcal{L} = L^* = \mathbb{Z}_2^{\alpha} = L \cup (\frac{\alpha}{2} + L)$ and $\mathcal{L}/L \cong \mathbb{Z}_2$. In this case,

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Question 2: For a given *D*, compute Aut D. Again it is related to the determination of $Aut V_{L_D}$ and the properties of the Monster group.

In general, if N is a sublattice of Λ of rank 24,

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Is $\sqrt{k}A_{\ell}^{24/\ell} \subset \Lambda$ for any positive integer k??