TORIC VARIETY

Abstract. In this seminar, we are trying to learn the basic theories of toric variety, and some selected topics. The main reference is [CLS11].

0. Schedule

0.1. **Lecture 1: Preliminaries (Bowen Liu 09/23).**

- Affine semigroups;
- Strongly convex rational polyhedral cone;
- Affine toric variety.

0.2. **Lecture 2: Projective toric variety (Chenchen Zuo 10/07).**

- Lattice points and projective toric varieties;
- Polytopes and projective toric varieties;
- Properties of projective toric varieties.

0.3. **Lecture 3: Fans and toric varieties, orbit-cone correspondence (Qiliang Luo 10/15).**

- Construction of toric varieties from fans;
- Examples of toric varieties.
- Orbit-Cone correspondence.

0.4. **Lecture 4: Toric morphism (Shengyu Hou 10/21).**

- Category of fans and categories of (normal) toric varieties.
- Examples.

0.5. **Lecture 5: Divisors on toric varieties (Bowen Liu 10/28).**

- Review of basic theory of divisors;
- Weil divisors on toric varieties;
- The sheaf of a torus-invariant divisor;

0.6. **Lecture 6: Canonical divisors of toric varieties (Bowen Liu 11/11).**

- Review of basic theory of Kähler differentials;
- Useful exact sequences of 1-forms on toric varieties;
- The canonical sheaf of toric varieties.

0.7. **Lecture 7: Sheaf cohomology of toric varieties (Bowen Liu 11/18).**

- Cohomology of toric divisors;
- Vanishing theorems.

0.8. **Lecture 8: Line bundles on toric varieties I (Shengyu Hou 11/26).**

- Base point freeness;
- Very ampleness.

0.9. **Lecture 9: Line bundles on toric varieties II (Shengyu Hou 12/16).**

- Intersection products on toric varieties;
- Nef cone and Mori cone.

0.10. **Lecture 10: Intersection theory on toric varieties (Chenchen Zuo 12/30).**

- Chow groups of toric varieties;
- Toric Hizebruch-Riemann-Roch theorem;
- Toric intersection theory.

0.11. **Lecture 11: GIT structure of toric varieties (Shengyu Hou).**

- Review of projective GIT;
- GIT structure of toric varieties;
- Examples;
- Homogeneous coordinate on toric varieties;
- Coherent sheaves on toric varieties.

References

[CLS11] David A. Cox, John B. Little, and Henry K. Schenck. *Toric varieties*, volume 124 of *Graduate Studies in Mathematics*. American Mathematical Society, Providence, RI, 2011.