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].

1. Schedule

1.1. Lecture 1: Preliminaries (Bowen Liu).

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

1.2. Lecture 2: Projective toric variety (Chenchen Zuo).

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

1.3. Lecture 3: Fans and toric varieties (Bowen Liu).

- Reivew of abstract variety;
- Construction of toric varieties from fans;
- Examples of toric varieties.

1.4. Lecture 4: Properties of toric varieties (Chenchen Zuo).

- Completeness;
- Smoothness;
- Properness.

1.5. Lecture 5: Orbit-Cone correspondence.

- Baby examples;
- Limit of one-parameter subgroups;
- Statement of the theorem.

1.6. Lecture 6: Divisors on toric varieties (Bowen Liu).

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

1.7. Lecture 7: Line bundles on toric varieties (Shengyu Hou).

- Base point freeness and very ampleness;
- Intersection numbers on toric varieties;
- Nefness and ampleness;
- Cones of divisors and cones of curves.

1.8. **Lecture 8: Canonical divisors of toric varieties (Bowen Liu).**

- One-forms on toric varieties;
- Differential forms on toric varieties;
- The canonical sheaf of toric varieties.

1.9. **Lecture 9: Sheaf cohomology of toric varieties.**

- Cohomology of toric divisors;
- Vanishing theorems.

1.10. **Lecture 10: 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.