
ANALYSIS STUDENT SEMINAR TOPIC

PROPOSAL: NOTIONS OF CONVEXITY

OVERVIEW

Convexity is a notion that can be understood in a wide sense and that is present in various areas of analysis: real analysis, complex analysis, functional analysis, harmonic analysis, calculus of variations, probability theory and partial differential equations; to name those only. Of course, notions of convexity that appear in various areas of analysis also have applications in geometry, graph theory, and areas of applied mathematics such as linear programming. Based on this, we hope that exploring some of these notions will appeal to a wide audience and give everybody the chance to learn how convexity, in a broad sense, can lead to many interesting results. More specifically, we will touch upon convexity in real analysis, some complex analysis and some functional analysis. Based on audience interest, we will choose special topics after the basic topics (talks 1 – 10) are covered.

REFERENCES

- [*A short history of Convexity*](#) by Roman J. Dvilewicz. (Survey paper.)
- [*Notions of Convexity*](#) by Lars Hörmander. (Book.)

TENTATIVE SCHEDULE:

1. Talk 1: Convex functions of one variable
 - Chapter I of Hörmander's book, sections 1.1, 1.2 and 1.5.
2. Talk 2: Convexity in a finite dimensional vector space – Part I
 - Chapter II of Hörmander's book, section 2.1 (1st half).
3. Talk 3: Convexity in a finite dimensional vector space – Part I
 - Chapter II of Hörmander's book, section 2.1 (2nd half).
4. Talk 4: Harmonic functions
 - Chapter III of Hörmander's book, section 3.1.
5. Talk 5: Subharmonic functions – Part I
 - Chapter III of Hörmander's book, section 3.2 (1st half).
6. Talk 6: Subharmonic functions – Part II
 - Chapter III of Hörmander's book, section 3.2 (2nd half).
7. Talk 7: Plurisubharmonic functions – Part I
 - Chapter IV of Hörmander's book, section 4.1 (1st half).
8. Talk 8: Plurisubharmonic functions – Part II
 - Chapter IV of Hörmander's book, section 4.1 (2nd half).
9. Talk 9: Other convexity conditions

- Chapter IV of Hörmander's book, section 4.6.
10. Talk 10: (Special topic.)
 11. Talk 11: (Special topic.)
 12. Talk 12: (Special topic.)
 13. Talk 13: (Special topic.)
 14. Talk 14: (Special topic.)

Special topics suggestions:

- Legendre transforms: sections 1.3 and 2.2 of Hörmander's book.
- Convexity of the minimum of a one parameter family of functions: section 1.7 of Hörmander's book.
- Harmonic majorants and the Riesz representation formula: section 3.3 of Hörmander's book.
- Exceptional sets: sections 3.4 and 4.5 in Hörmander's book.