Topic 1: “Lie groups and representation theory”
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Abstract 1: We will study the classification and representations of compact Lie groups. Knowledge of this material is useful in all areas of mathematics.
A feature of this course is that we will cover it from a more geometric viewpoint than usual.

1) Classification of complex semisimple Lie algebras via their root systems. By taking real forms, we will apply this to the classification of compact Lie groups.
2) Classification of complex representations of complex semisimple Lie algebra. It is somewhat more delicate to derive from this the real representations of compact Lie groups.
3) Applications to some problems in geometry.
4) If time permits, discuss the theory of symmetric spaces with applications of 1)-3) in mind.

Prerequisites 1:
Basic knowledge of manifolds and covering space theory.
Some of the basics of Lie groups (which will be reviewed quickly) as e.g. on p. 1-17 on my notes below.

Literature:
There are too many books on representation theory to list here. I will mainly rely on my own notes on my homepage:

https://www2.math.upenn.edu/~wziller/math650/LieGroupsReps.pdf

These will be expanded significantly before, during and after this course.