University of Chicago
Paris Mathematics Program
Spring 2016
Course Offerings

Course 1 (Weeks 1-3): Math 29522: Theory and Applications of Ultrafilters

March 28-April 15
Instructor: Maryanthe Malliaris

Ultrafilters on a set X are maximal (under inclusion) subsets of the power set of X which are closed upward, closed under finite intersection, and do not contain the empty set. From this simple definition arises a very rich set of ideas, first noticed by Bourbaki and others in the 1930s and developed much further over the course of the twentieth century. Ultrafilters over infinite sets give a generalized notion of limit, and they also allow us to compute averages of infinitely many objects via the ultraproduct construction. We will cover the basics of ultrafilters and ultraproducts and the building of different types of ultrafilters, and discuss some applications in combinatorics, logic, topology, and algebra as time permits. The course will have a final project.

Course 2 (Weeks 4-6): Math 29507: Geometry of Matrix Groups

April 18-May 6
Instructor: John Boller

We will discuss the structure of general and special linear groups, orthogonal groups, unitary groups, and symplectic groups. These groups are used throughout algebra, topology, and analysis. We will emphasize the roles of matrix groups in each of these fields, and present examples where the knowledge of these groups leads to the solution of interesting problems. The text for the course is *Matrix Groups*, by Morton Curtis. Instead of a final exam, there will be final projects, and the level of difficulty of the project chosen will determine whether this course may be substituted for Math 25600 or Math 25900 in the B.S. degree program.

Course 3 (Weeks 7-9): Math 29519: Introduction to Fourier Analysis

May 9-May 27
Instructor: Takis Souganidis

This will be an elementary introduction to the study of Fourier Series and integrals. We shall ask, "When do Fourier Series converge?" If they do not converge, (and they don't always) we shall ask whether there is some notion that is more general than ordinary convergence, according to which Fourier series represent the function they are supposed to represent. We shall study special cases of Fourier Series that are particularly interesting, such as lacunary series, and random series. We shall cover the relationship between the size of a function and the size of its Fourier coefficients (or, in the non-periodic case) the Fourier Transform. We shall also investigate the relationship between Fourier analysis and partial differential equations, as well as other interesting topics as time permits.

To apply, go to the foreign studies website (http://study-abroad.uchicago.edu/) and fill out the on line form for Paris Math Spring 16. There is no need to get a recommendation; we do not require them for this program. We will evaluate your application by considering your math background and your

overall transcript. To be eligible to take these math courses, you must have completed any analysis sequence and either Math 25800 or Math 25500.