Math 566 Ramsey Theory Spring 2025

Instructor Amites Sarkar

Text None. I will provide typed notes for the main theorems.

Syllabus

Graphs and hypergraphs

Ramsey's theorem (finite and infinite versions); compactness principle; monotone subsequence theorem; Erdős–Szekeres upper bound for $R(k)$; probabilistic lower bound for $R(k)$; applications; new upper bound for $R(k)$ (without proof)

Progressions and cubes

Van der Waerden's theorem; the Hales–Jewett theorem; Gallai's theorem; Szemerédi's theorem and the density Hales-Jewett theorem (without proof)

Partition regularity

Schur's theorem; the columns condition and Rado's theorem; Folkman's theorem; Hindman's theorem

Notes

Ramsey theory grew out of the work of Ramsey, Schur, van der Waerden, Erdős and Szekeres between 1916 and 1935. From the beginning, it had applications to logic, number theory and geometry, and, while these connections are still there, Ramsey theory is now a very well developed subject in its own right. My main aim is to cover the classical theorems listed above, and my second aim is to describe some of the astonishing recent progress in the field.

Course objectives

The successful student will know the statements, proofs and context of the above theorems, and be able to apply these theorems to solve related problems.

Relation to overall program goals

Among other things, this course will (i) enhance your problem-solving skills; (ii) help you recognize that a problem can have different useful representations (graphical, numerical, or symbolic).

Exams

Midterm Monday 28 April
Final Monday 9 June 8–10 am. This will be a closed book exam.

Grading

I will base the grade on the **midterm** (worth 25%), **presentations** (worth 25%; you'll have to do 50 minute presentations (in pairs) at the end of the quarter), and the **final** (worth 50%). I'll talk more about the presentations in class, and I'll also distribute a list of possible presentation topics.

Office hours

My office hours are 9–9:50 on Mondays, Tuesdays and Thursdays, and 11-11:50 on Fridays, in 216 Bond Hall. My e-mail is amites.sarkar@wwu.edu.