Term Information

Effective Term	Autumn 2016
Previous Value	*Summer 2012*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

We propose to change Math 6501 and 6502 from 5-credit to 3-credit courses. We also are taking the opportunity to update the syllabus for each course to a more modern combinatorics curriculum. Moreover, old references to quarter courses are eliminated.

What is the rationale for the proposed change(s)?

Almost all of our 6000-level courses are 3-credit courses. We hope that this will resolve scheduling issues which we have had in recent years, and also problems with low enrollment. We are also happy to update the curriculum to reflect current research areas of broad interest and applications of interest to PhD students in engineering disciplines and theoretical computer science. This is in part also motivated by several recent faculty hires in the area.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

This will not change any program requirements. However, we hope that it will make it easier for PhD students to satisfy a breadth requirement by taking the 6501-6502 sequence, and also expedite PhD students in combinatorics and discrete mathematics to their research programs.

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Mathematics
Fiscal Unit/Academic Org	Mathematics - D0671
College/Academic Group	Arts and Sciences
Level/Career	Graduate
Course Number/Catalog	6502
Course Title	Combinatorics and Graph Theory II
Transcript Abbreviation	Combin Graph Thy 2
Course Description	Ramsey theory, extremal graph theory. First moment method, second moment method, alterations. Concentration inequalities. Lovasz local lemma. Martingale methods. Correlation inequalities. Phase transitions. Random trees, random planar maps.
Previous Value	*Combinatorial designs and geometries; coding theory; enumeration, Moebius inversion and Polya theory; algebraic graph theory, spectrum of graphs; association schemes; combinatorics of the symmetric groups; generating functions and q-series.*
Semester Credit Hours/Units	Fixed: 3
Previous Value	*Fixed: 5*

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture

Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Math 6501 or permission of instructor
Previous Value	*6501 (776).*
Exclusions	
Previous Value	Not open to students with credit for 777.

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	27.0102
Subsidy Level	Doctoral Course
Intended Rank	Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- This course is meant to introduce graduate students to probabilistic combinatorics. An emphasis is placed on covering the fundamentals of these subjects at a fast pace, emphasizing areas which are important for applications.

Previous Value

Content Topic List

- Ramsey theory, extremal graph theory.
- First moment method, second moment method, alterations.
- Concentration inequalities.
- Lovasz local lemma.
- Martingale methods.
- Correlation inequalities & Phase transitions.
- Random trees, random planar maps.

Previous Value

- *Combinatorial designs and geometries*
- *Coding theory*
- *Enumeration, including Moebius inversion and Polya theory*
- *Algebraic graph theory and spectrum of graphs*
- *Association schemes*
- *Combinatorics of the symmetric groups*
- *Generating functions and q-series*

Attachments

- MATH_6502_Ed_Syllabus.pdf: 6502 Syllabus

  (Syllabus. Owner: Kerler,Thomas)

- MATH_6502_OLD_Syllabus.pdf: OLD 6502 Syllabus

  (Syllabus. Owner: Kerler,Thomas)

Comments

- Please also attach 5-credit syllabus of 6502 for comparison. *(by Vankeerbergen,Bernadette Chantal on 12/04/2015 12:16 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kerler,Thomas	12/01/2015 01:52 PM	Submitted for Approval
Approved	Husen,William J	12/01/2015 01:57 PM	Unit Approval
Approved	Haddad,Deborah Moore	12/01/2015 03:15 PM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	12/04/2015 12:22 PM	ASCCAO Approval
Submitted	Kerler,Thomas	12/05/2015 06:30 PM	Submitted for Approval
Approved	Husen,William J	12/05/2015 06:46 PM	Unit Approval
Approved	Haddad,Deborah Moore	12/05/2015 07:36 PM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole	12/05/2015 07:36 PM	ASCCAO Approval

Combinatorics and Graph Theory II

Instructor and Class Information

Lecturer:	**Course Num.:**
Office:	**Lecture Room:**
Phone:	**Lecture Times:**
Email:	**Office Hours:**

About Course Goals

Format

The course will meet three times a week for 55 minutes each meeting. Instructions will be mainly by lecture delivered by the instructor. It may also include occasional in-class discussion as well as short student presentations, particularly, by post-candidacy students.

Content & Goals

This course is meant to introduce graduate students to probabilistic combinatorics. An emphasis is placed on covering the fundamentals of these subjects at a fast pace, emphasizing areas which are important for applications. Many open problems and areas of current research will be pointed out along the way.

Prerequisites

Math 6501 or permission of instructor

Textbook

Main Reference

Noga Alon and Joel Spencer:*"The Probabilistic Method: Third Edition".* Wiley, 2008. ISBN: 978-0470170205

Assessments

Homework Assignments

There will be approximately 10 homework assignments, which will each include problems of varying difficulty. Due dates of assignments will be announced and set typically a week after the assignments are published

Final Project

The final project is a more extensive written assignment that will draw on techniques acquired throughout the semester. It will be published about two weeks before the end of classes and will be dues at the beginning of finals week.

Class Participation and Attendance

Although attendance is not regularly monitored frequent absences are likely to be noted and may factor into the grade in borderline cases.

Grading

Course Score

A course score will be computed from the above assessments. Homework assignments will count 70% towards the grade and the final project 30%.

Letter Grades

Letter grades will be determined based on the course score. The approximate minimum scores letter grades are 80% for an “A”, 73% for an “A-”, 67% for a “B+”, 55% for a “B-”, and 40% for a “C-”. The exact cut-off scores may vary depending on the difficulty of assignments.

Weekly Schedule

Week 1	Introduction to the probabilistic method: the first moment method
Week 2	Lower bounds on Ramsey numbers, extremal graph theory
Week 3	Probabilistic method with alterations: graphs with large girth and chromatic number
Week 4	Second moment method I: Chebyshev's inequality and applications
Week 5	Second momemnt method II: Random graphs, thresholds for subgraphs
Week 6	Lovasz Local Lemma and applications
Week 7	Poisson paradigm I: method of moments, Stein's method
Week 8	Poisson paradigm II: Janson's inequality and applications
Week 9	Concentraion of measure: Chernoff bounds
Week 10	Martingale methods: vertex and edge revealing filtrations, Azuma's inequality
Week 11	The phase transition in the random graph
Week 12	Correlation inequalities
Week 13	Random trees
Week 14	Random planar maps

General Policies

Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/info_for_students/csc.asp).”

Disability Services

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/.

Combinatorics and Graph Theory II

Instructor and Class Information

Lecturer:	**Course Num.:**
Office:	**Lecture Room:**
Phone:	**Lecture Times:**
Email:	**Office Hours:**

About Course Goals

Format

The course will meet five times a week for 55 minutes each meeting. Instructions will be mainly by lecture delivered by the instructor. It may also include occasional in-class discussion as well as short student presentations, particularly, by post-candidacy students.

Content & Goals

This course is meant to introduce graduate students to advanced combinatorial, probabilistic, and graph theoretic methods. An emphasis is placed on covering the fundamentals of these subjects at a fast pace, emphasizing areas which are important for applications. Many open problems and areas of current research will be pointed out along the way.

Prerequisites

Math 6501 or permission of instructor

Textbook

Main Reference

Reinhard Diestel: *"Graph Theory"*, Graduate Texts in Mathematics **173**. Springer; 4th ed. 2010. ISBN: 978-3642142789.

Noga Alon and Joel Spencer:*"The Probabilistic Method: Third Edition".* Wiley, 2008. ISBN: 978-0470170205

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Weekly Schedule

Week 1	Combinatorial designs
Week 2	Finite geometries: finite projective planes, ovoids
Week 3	Introduction to error correcting codes: sphere-packing bounds, Shannon bounds
Week 4	Hamming codes, binary Golay codes
Week 5	Moebius inversion: inclusion-exclusion and sieve methods
Week 6	Algebraic graph theory I: adjacency matrices, Laplacians
Week 7	Algebraic graph theory II: spectral graph theory, strongly regular graphs
Week 8	Probabilistic method I: first-moment method
Week 9	Probabilistic method II: second-moment method, concentration of measure
Week 10	Applications of probabilistic method: existence of expanders, metric distortion
Week 11	Association schemes: finite groups, distance regular graphs
Week 12	Combinatorics of symmetric group I: permutation statistics
Week 13	Combinatorics of symmetric group: II: symmetric functions and representation theory, Schur functions
Week 14	q-series: q-Pochhammer symbol, q-analogues of combinatorial identities

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