Course: M 584 Sec. 01 (CRN 33043) 3 cr., Spring 2020
Topics in C & O: Matching Theory
TΘ 11:00am–12:20pm in MATH 211

Instructor: Mark Kayll
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hs.umt.edu/math/people/default.php?s=Kayll
Office: MATH 209
406.243.2403
Hours: T 1:00–1:50pm, Θ 12:20–1:10pm & by appointment
tentative (open for all course matters, including DSS accomm.)

Prerequisites: background suitable for graduate-level mathematics. Additionally, it’s desirable to have some prior exposure to discrete mathematics or optimization, as might be gained from M 485 (Graph Theory), M 581 (Combinatorics), or M 582 (Optimization). Students excelling in M 361 (Discrete Optimization) or M 325 (Discrete Mathematics) should also be prepared for this course.


Important Dates: Martin Luther King, Jr. Day holiday Monday, 20 January;
last day to add by Cyberbear Wednesday, 22 January (5pm);
last day to drop by Cyberbear, or select Audit grade option Monday, 3 February (5pm);
Presidents’ Day holiday Monday, 17 February;
International Day of Mathematics Saturday, 3.14;
spring break 16–20 March;
last day to drop via Add/∆/Drop link and avoid ‘WP’ or ‘WF’ Tuesday, 24 March (5pm);
Math Awareness Month April (watch for events);
last day to add/drop by petition Friday, 1 May (5pm);
last class meeting (during finals) Monday, 4 May 8:00–10:00am.

Description: Matching theory offers a lens into the study of graphs that beautifully combines structural considerations and optimization. For example, while Tutte’s 1-factor theorem confirms that an ‘obvious’ necessary condition for a graph to contain a perfect matching is also sufficient, Edmonds’ blossom algorithm gives an efficient method for finding a maximum matching in a graph.

This course samples and surveys matching theory from both perspectives. Planned topics include bipartite matching (e.g., theorems of P. Hall, König, and König-Egerváry), general matching (e.g., theorems of Berge, Tutte, and Gallai-Edmonds), and algorithms (e.g., the Hungarian Method and Edmonds’ Algorithm). Time permitting, we’ll also consider the theory’s connections with polyhedral combinatorics and linear programming.

Topics should appeal both to students with a general interest in combinatorics and to students seeking research problems to support their graduate degrees. Folks who didn’t take specific courses listed among the prerequisites need not fear—the instructor will provide refreshers on earlier concepts and results as needed.

(over)
Assessment: Grades are based on performance on items to be discussed in class, e.g., attendance, homework, and a presentation (not exams). Traditional letter grades will be assigned using the +/− system (see UM catalog at https://montana-catalog.coursedog.com/academics/policies-procedures). UM’s policy on Incomplete grades will be followed (see UM catalog).

Homework: Details will be discussed in class.

Presentations: Each presentation consists of an academic-hour lecture scheduled during a regular, or final, class meeting. The content of the presentations should be related to the course content and may be inspired by one or more sections of the text, by related paper(s), or by other related material. Students should schedule their lecture date privately with the instructor early in the semester; time slots are assigned on a first-come, first-served basis. Lecture topics must be approved by the instructor, and students should take the following preparatory steps.

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<thead>
<tr>
<th>Step</th>
<th>Timing</th>
<th>Action</th>
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<tbody>
<tr>
<td>0</td>
<td>early in semester</td>
<td>Schedule lecture date with instructor.</td>
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<tr>
<td>1</td>
<td>3 weeks prior to lecture</td>
<td>Submit a ≤ 1-page typed summary proposal of lecture topic, with references.</td>
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<tr>
<td>2</td>
<td>2 weeks prior to lecture</td>
<td>Receive proposal approval or suggested modifications from instructor.</td>
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<tr>
<td>3</td>
<td>1 week prior to lecture</td>
<td>Meet with instructor privately for final informal discussion of lecture topic; be prepared to field questions.</td>
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Accommodation: The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you have a disability that adversely affects your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406.243.2243. The instructor will work with you and Disability Services to provide an appropriate modification.

General Remarks

On homework: Please use complete sentences, proofread, and polish your work prior to submission. You’re encouraged to type homework solutions unless your handwriting is clear. You may work with others on homework problems, and you’re encouraged to do so; however,

Solutions should be written down privately in your own words.

If you use an important idea of someone else, then please acknowledge that person by giving an appropriate citation in your write-up. This professional courtesy will not affect your grade.

On make-ups: There are no homework make-ups; this policy will be elaborated in class.

On deadlines: Any stated deadlines are firm; please do not ask for extensions. (Violating this request is considered grounds for a penalty on the corresponding assignment.)

On electronic devices: Cell phones must be silenced during class meetings and office hour visits.

On conduct: All students need to be familiar with the Student Conduct Code; it can be found in the ‘A to Z Index’ on the UM home page. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the university.

Additional References


1Combinatorics is the most fundamental, and hence the most important, branch of mathematics, since it deals with FINITE structures, and the world is finite.

Doron Zeilberger, Board of Governors Professor of Mathematics
Rutgers University