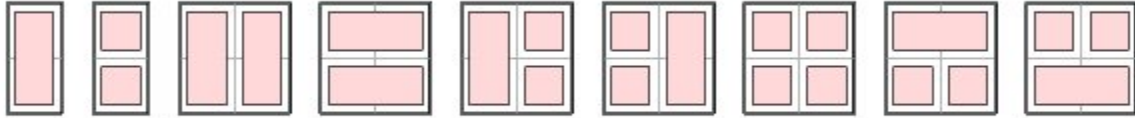


Math 3152a -- Combinatorial mathematics (Fall 2021)



Instructor	Graham Denham
Office hours	Thursday 3:30-4:20pm, Friday 2:30-2:30pm
Class times	Tu 2:30-4:30pm, Th 2:30-3:30pm
Class location	MC 17
Textbook	<i>A Walk Through Combinatorics</i> , 4th edition, Miklós Bóna, available at the bookstore
Prerequisites	0.5 course from: Mathematics 2120A/B , 2155A/B , 2211A/B , Applied Mathematics 2811B , or permission of the Department.
Midterm exam date	October 19 (in class)
Final exam	Scheduled by the registrar
Evaluation	40% Final exam; 30% midterm; 30% assignments

Reading

Brualdi's book *Introductory Combinatorics* is a good secondary reference. The course synopsis below will contain other specific suggestions as the course progresses.

Synopsis

A week-by-week record of what's going on will appear here.

Syllabus

This is an intermediate course in enumerative combinatorics, the study of counting. There are not many formal prerequisites, but you will enjoy the course best if you have some enthusiasm for problem-solving and hands-on math. We will review the basics -- how to count permutations and combinations of labelled and unlabelled objects. We will see how to use formal power

series (also known as generating functions) to solve counting problems easily and systematically. The usual topics include:

- the pigeonhole principle
- permutations and combinations of sets and multisets
- introducing formal power series
- ordinary and exponential generating functions
- solving recurrence relations
- counting graphs and trees
- Joyal's theory of species
- counting in the presence of symmetry (Polya theory) or Lagrange inversion

Assignments

Learning the art of counting requires, above all, practice. Accordingly, there will be six homework assignments, due approximately every two weeks. This is the most important part of the course. Please note that no late assignments will be accepted. See the [homework page](#) for an up-to-date list.

Some of the assignment problems will be routine, and some will take some thought. Collaborating with other people can add a lot to the experience of doing math, and I encourage you to do so. (Research-level mathematics can be done alone, but is probably more often done in groups of two or three.) Just make sure to write your own solutions, your own way, and to acknowledge any debts you may have. Ask me if in doubt, since presenting the work of others as your own constitutes a serious academic offence.

Sometimes it can be useful to use some symbolic computation software, for example to evaluate a few terms of a power series. Try Maple or Mathematica, if you have access or familiarity. You can also use [Sage](#), an open-source symbolic computation tool, online and for free. For example, create a Sage notebook, and enter the following:

```
var('t')
f = e^(e^t-1)
f.taylor(t,0,10)
```

This will give you the first ten terms of the exponential generating function for the Bell numbers, which we will learn about in early November.

Exams

There will be one midterm, taking place on October 19th.

Further information

In accordance with [policy](#), the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Academic dishonesty: Scholastic offences are taken seriously and students are directed to read the [official policy](#).

Accessibility Statement: Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 for any specific question regarding an accommodation.

Support Services: Learning-skills counsellors at the [Student Development Centre](#) are ready to help you improve your learning skills. Students who are in emotional/mental distress should refer to [Mental Health@Western](#) for a complete list of options about how to obtain help. Additional student-run support services are offered by the [USC](#). The website for Registrarial Services is <http://www.registrar.uwo.ca>. Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations. Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>. Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling. Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/mentalhealth>) for a complete list of options about how to obtain help. Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.

Eligibility: You are responsible for ensuring that you have successfully completed all course prerequisites and that you have not taken an antirequisite course. Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Public Health Contingencies: In the event that public health restrictions make it impossible for class to meet in person, class will continue as scheduled by Zoom. In that case, you would be responsible for the usual elements of remote learning: you would need a working computer with microphone and camera, as well as solid internet connection. If the midterm cannot be completed

on paper, remote proctoring software will be used in order to facilitate a home exam. If the final exam cannot be completed on paper, an oral exam conducted by Zoom will replace the written exam.

Academic Consideration for Student Absences:

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
 - an absence must be no more than 48 hours
 - the assessments must be worth no more than 30% of the student's final grade
 - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Religious Accommodation:

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their

absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

Absences from Final Examinations:

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

Accommodation policies:

Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf