COURSE INFORMATION
MATH 3U03 (Combinatorics) – Winter 2017

I. Course Objectives. MATH 3U03 is a mathematical introduction to combinatorics, that is, counting. Some of the topics covered in this course are basic counting, the binomial theorem, generating functions, and recurrence relations. The main objectives of this course are

- to learn the basic terminology and results concerning combinatorics.
- to learn proof techniques for combinatorial problems.
- when applicable, use computer software.
- to learn about open problems in combinatorics.

The prerequisites for this course are one of MATH 2A03, 2X03 or ISCI 2A18 and MATH 2R03. An anti-requisite for this course is MATH 4C03.

II. Administrative Details.

Time	Class: MTh 12:30-1:20, Tu 1:30-2:20
Place	Class: Hamilton Hall 217
Instructor	Adam Van Tuyl
	Office: Hamilton Hall 419
	Office Hours: TBA (see my webpage)
Text	*How to Count*, by Robert Beeler
Email	`vantuyl@math.mcmaster.ca`
Web Page	`http://ms.mcmaster.ca/~vantuyl/courses/2017_winter_math3U03.html`

The best way to contact me is via email. The class webpage is also a good source of information. I update the webpage after every class.

III. Course Assessment. The final grade is composed of three components.

1. **Homework (20%)** A homework assignment will be given out every week on Thursday, and due the following Thursday at the beginning of class. All of the homework questions (with some possible exceptions) will be taken from the text book. Depending upon the assignment, only a subset of the questions may be graded. In general, there are two types of problems: (a) computational problems and (b) proof problems.

   (a) Computational Problems

   Computation problems are exercises that review the concepts and definitions introduced in the section. These exercises will be marked out of 2 points as follows:

   2 pts Near perfect or perfect solution. A near perfect solution is a solution that is correct up to the final stage with possible mistake or sign error at the last step.
   1 pt The solution shows some of the needed ideas, but fails to have the final solution.
   0 pts Little or no progress is made toward the solution.

   (b) Proof Problems

   These exercise usually involve proving statements using the results and concepts of the corresponding section. The majority of problems assigned will be of this type. These exercises will also be graded on how the proof has been written. These problems will be graded out of 5 points as follows:

   5 pts A correct solution and a well written proof.
   4 pts Most of the required ingredients are present, but there are a few technical problems with the solution.

3 pts Some of the needed ideas are present. However, the solution either lacks the final conclusion or has some problems in the exposition.
2 pts The proof has at most one or two of the needed ideas and/or the proof is poorly written.
1 pt An attempt to the solution has been made, but there is a major flow in the logic of the proof, or the proof is not well written.
0 pts Little or no progress is made toward the solution.

There will be 9 homework assignments. The lowest mark of the nine homework assignments will be dropped.

Homework Presentation: Since an important part of this course is writing proofs, I am going to be very picky about your write up. In particular, you must use the following guidelines when writing your solutions:

- Every assignment must contain the course number, the assignment number, your name, and your student ID, and the instructor's name.
- Always include the question in your write up. In addition, please use only one side of the paper so there is room for comments.
- Homework must **always** be stapled together (no paper-clips, folding the pages, folders, etc. will be accepted). Failure to do this will result in **10 points deducted** from the assignment. (Paper-clipped assignments have the tendency to fall apart; assignments in folders make more work for the grader.)
- Late homework will have **10 points deducted** for every day (the weekend is counted as one day) that is late. Once the homework assignments have been handed back, you may no longer submit an assignment.
- The copying of assignments will result in a mark of 0 for both assignments.
- Homework may be handed in early by either giving it to me or by placing it under my office door. Do **not** bring your assignment to the math office.

Homework will have **10 points deducted** if any of the above style guidelines are not met.

2. **Exams (2 Midterms 15% each = 30%, Final Exam 40%)** There will be two midterms and a cumulative final exam (2.5 hours). I will give more details about the tests nearer to the test dates. The tentative dates of the midterm are:
   February 6, 2017 - Midterm 1
   March 13, 2017 - Midterm 2

3. **Project (10%)** For more details on this, see the last page.

IV. Class Policies. Though attendance is not mandatory, I would appreciate the fact that you show up on time if you do decide to come to class. I highly recommend that you do come to class. Some of the topics can be quite complicated.

V. Important Dates.

Jan. 4, 2017 - Second semester begins
Feb. 9, 2017 - Project topic due
Feb. 6, 2017 - Midterm 1
Feb. 20-26, 2017 - Fall Midterm Break (No classes)
Mar. 9, 2017 - Draft of project due
Mar. 10, 2017 - Last day for cancelling courses without failure by default
Mar. 13, 2017 - Midterm 2
Mar. 30, 2017 - Project due
Apr. 6, 2017 - Second semester ends
Apr. 14, 2017 - Good Friday (No classes/exams)
Apr. 11-27, 2017 - Final Exams

A friendly piece of advice: do not book your plane ticket home until you are certain about the exam schedule. A flight is not an acceptable excuse for missing an exam.

OFFICIAL McMASTER POLICIES

1. Policy on Academic Ethics. You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at:

`http://www.mcmaster.ca/academicintegrity/`

The following illustrates only three forms of academic dishonesty: (1) plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained. (2) improper collaboration in group work, and (3) copying or using unauthorized aids in tests and examinations.

2. Policy regarding missed work. If you have missed work, it is your responsibility to take action.

If you are absent from the university for medical and non-medical (personal) situations lasting fewer than 3 days, you may report your absence, once per term, without documentation, using the McMaster Student Absence Form (MSAF). Please see

`http://academiccalendars.romcmaster.ca/content.php?catoid=13&navoid=2208`
`#Requests_for_Relief_for_Missed_Academic_Term_Work`

Absences for a longer duration or for other reasons must be reported to your Faculty/Program office, with documentation, and relief from term work may not necessarily be granted. **In Math 3U03, the percentages of the missed work will be transferred to the final examination.** Please note that the MSAF may not be used for term work worth 25% or more, nor can it be used for the final examination.

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar Requests for Relief for Missed Academic Term Work. Please note these regulations have changed beginning Fall 2015.

3. Student Accessibility Services. Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail `sas@mcmaster.ca`. For further information, consult McMaster Universitys Policy for Academic Accommodation of Students with Disabilities.

4. Important Message. The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

MATH 3U03 (Combinatorics) – Winter 2017
Project Information

Combinatorics is a very active area of current research mathematics. In class, we will discuss a number of open problems. In this project, you will find an open conjecture or problem not discussed in our course and write a short report on this conjecture. You may work with a partner if you wish.

The report will be 2 to 3 pages long. You must include the following information.

1. The relevant definitions and results needed to state the conjecture or problem.
2. A clear statement of the conjecture or problem.
3. A summary of who made the conjecture or problem and where, i.e., where did the conjecture or problem first appear in the literature.
4. A short summary of what is known (e.g., known cases).
5. An example that satisfies the conjecture/problem (or make a program to test the conjecture/problem).
6. A bibliography with at least five papers related to the conjecture.

TOPIC. You must pick a conjecture not covered in class. A good place to get your feet wet is the web page:

`http://www.openproblemgarden.org/category/combinatorics`

Or you could try the library. Check out journals like the American Mathematical Monthly, the Mathematics Magazine, or the College Math Journal. The last two can be searched at:

`http://www.math.hmc.edu/journals/journalsearch2/`

Find something that interests you. All topics must be first cleared with me.

WRITE UP. You will write a report that addresses the six points given about. Your report should be 2 to 3 pages, and at most 4 pages. It is required that is be to be typed (LaTeX is preferred, but not required). Written work will be graded on the mathematical content, as well as the clarity of the exposition.

In your write up, I will expect you to include correct mathematical references. Here are some samples. The first is for a journal, the second is for a book:

1. A. Van Tuyl, The defining ideal of a set of points in multi-projective space. J. London Math. Soc. (2) **72** (2005), 73–90.
2. R. H. Villarreal, *Monomial algebras.* Marcel Dekker, Inc., New York, 2001.

Web pages are a little bit more complicated. For a complete list of possibilities, see:

`http://www.virtualsalt.com/mla.htm`

TIME-LINE. The following schedule will be used:

Feb. 9, 2017 – Topic picked, with evidence of references, cleared by me. If you are working in pairs, I need to know who is working with whom.
Mar. 9, 2017 – Draft submitted for feedback.
Mar. 30, 2017 – Project submitted.