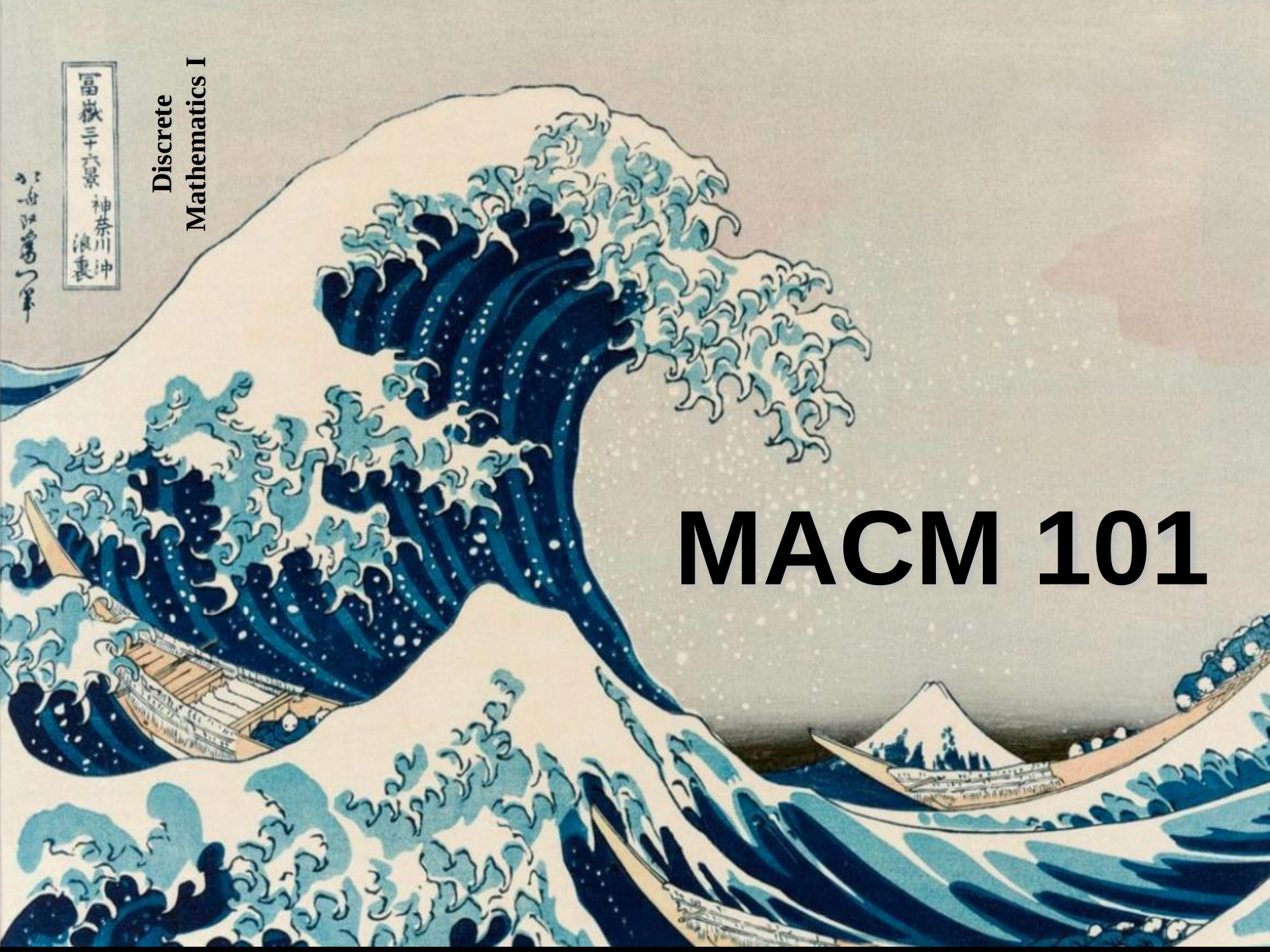
Discrete
Mathematics I
MACM 101

MACM 101 – Fall, 2024

My Teaching Schedule > 2024 Fall > Simon Fraser University

View All | First 1-11 of 11 Last

Class	Class Title	Enrolled	Days & Times	Room	Class Dates
CMPT 276-D300 (7478)	Intro Software Engineering (Lecture)	100	Mo 12:30PM - 1:20PM	AQ3149	Sep 4, 2024- Dec 3, 2024
			We 12:30PM - 2:20PM	AQ3149	Sep 4, 2024- Dec 3, 2024
MACM 101-D100 (6211)	Discrete Math I (Lecture)	151	MoWeFr 9:30AM - 10:20AM	B9201	Sep 4, 2024- Dec 3, 2024
MACM 101-D101 (6365)	Discrete Math I (Tutorial)	25	Fr 10:30AM - 11:20AM	AQ5039	Sep 4, 2024- Dec 3, 2024
MACM 101-D102 (6366)	Discrete Math I (Tutorial)	25	Fr 10:30AM - 11:20AM	BLU10901	Sep 4, 2024- Dec 3, 2024
MACM 101-D103 (6367)	Discrete Math I (Tutorial)	25	Fr 11:30AM - 12:20PM	AQ5039	Sep 4, 2024- Dec 3, 2024
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MACM 101-D106 (6370)	Discrete Math I (Tutorial)	7	Fr 12:30PM - 1:20PM	BLU10901	Sep 4, 2024- Dec 3, 2024
MACM 101-D107 (6371)	Discrete Math I (Tutorial)	18	Fr 1:30PM - 2:20PM	AQ5039	Sep 4, 2024- Dec 3, 2024
MACM 101-D108 (6372)	Discrete Math I (Tutorial)	4	Fr 1:30PM - 2:20PM	BLU10901	Sep 4, 2024- Dec 3, 2024

MACM 101 – Fall, 2024

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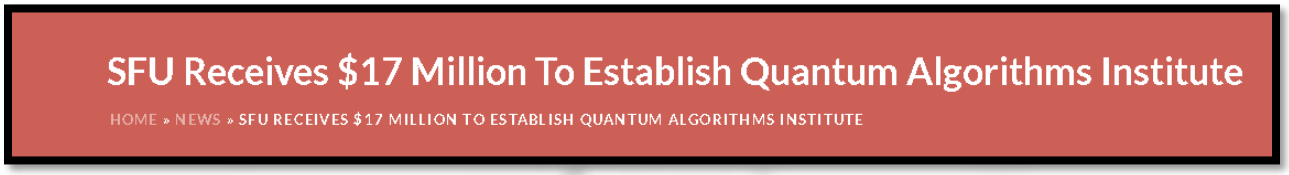
Find your tutorial section on GoSFU.

No tutorials during the first week.

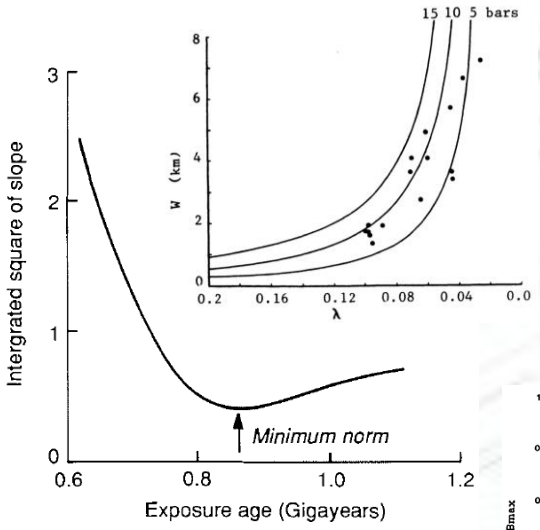
ADMINISTRATIVE

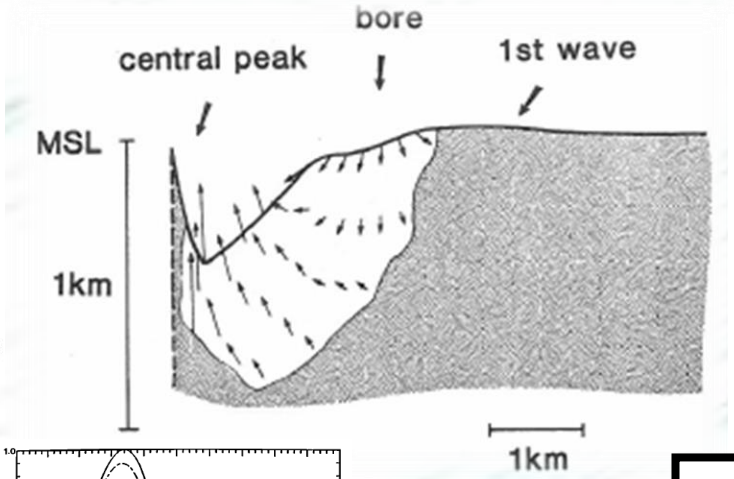
- **Instructor**: Dr. Steven Pearce
  - *Theoretical astrophysicist* and *applied mathematician*.
  - *Faculty Member* of the School of Computing Science at Simon Fraser University for twenty-five years.
  - *Graduate Advisor* for Department of Mathematics, SFU (2010-2012).
  - *Visiting Professor* of Mathematics at IIIT-Allahabad, India, 2015.
  - Developing the academic program in *Quantum Computing* in the School of Computing Science in collaboration with the Departments of Physics, Mathematics and Engineering in an interdisciplinary initiative as part of the SFU Quantum Algorithms Institute.

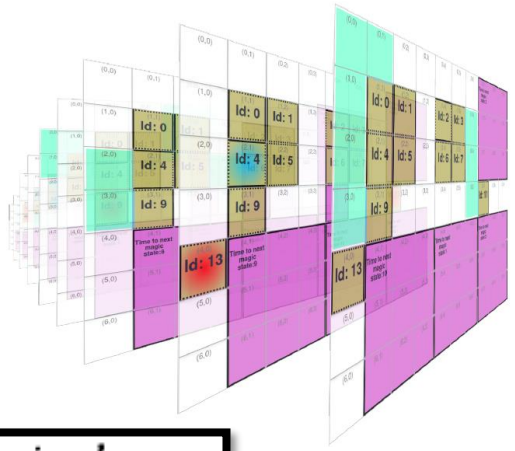


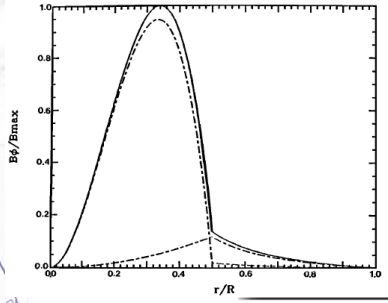
Areas of Research:

Computational-Fluid-Mechanics, -Magneto-Fluid-Mechanics, High Energy Astrophysics, Spectral Methods in PDEs, and Quantum Error Correction.

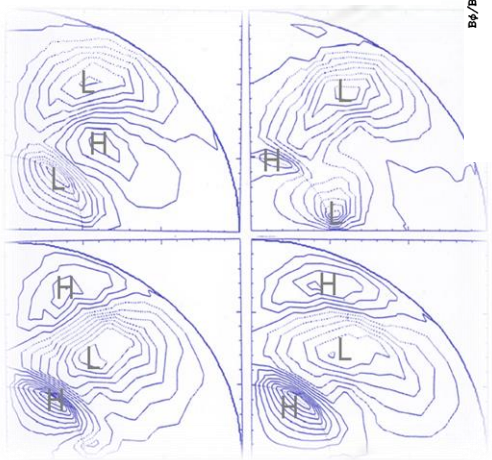








$$\langle {}^{j}h_{i} | {}^{l}h_{k} \rangle$$



Zentralblatt MATH Database 1931 – 2014

Zbl 1275.33021

Taghavi, A.; Pearce, S.

A solution to the Lane-Emden equation inthetheory of stellar structure utilizing the Tau method. (English)

Math. Methods Appl. Sci. 36, No. 10, 1240-1247 (2013). ISSN 0170-4214; ISSN 1099-1476/e

http://dx.doi.org/10.1002/mma.2676

http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099-1476

ADMINISTRATIVE

- **Instructor**: Dr. Steven Pearce
  - **Office hours**; one hour after Monday's class.
- **TAs:**
    - Ali Alimohammadi <aaa223@sfu.ca>,
    - Swaifa Haque <sha392@sfu.ca>,
    - Danush Adhitya Muthuvel <dam18@sfu.ca>,
    - Yarui Qiu yqa39@sfu.ca
  - **Office hours**: Your tutorial section is your office hour.

Learning Outcomes

"At the end of this course, students should be able to . . . "

- Solve basic counting problems involving permutations and combinations;
- Construct and manipulate sets, both finite and infinite, and apply the Inclusion-Exclusion Principle to counting problems;
- Use logical connectives and quantifiers in mathematical arguments;
- Prove the validity of arguments employing rules of logical inference;
- Use mathematical induction in simple proofs;
- Introduce recursively defined sets and their relationship to mathematical induction;
- Define relations and functions using set theory;
- Manipulate functions and relations and determine their common properties;
- Solve problems and prove theorems related to basic number theory;
- Explain basic terminology of graphs and trees including traversals of rooted trees;
- Introduce basic graph and tree algorithms.

Course Description

Discrete Mathematics I MACM 101 (3)

Introduction to graph theory, trees, induction, automata theory, formal reasoning, modular arithmetic. Prerequisite: BC Math 12 (or equivalent), or any of MATH 100, 150, 151, 154, 157. Quantitative/Breadth-Science.

Section	Instructor	Day/Time	Location
D100	Steve Pearce	May 6 – Aug 2, 2024: Tue, 10:30–11:20 a.m. May 6 – Aug 2, 2024: Thu, 9:30–11:20 a.m.	Burnaby Burnaby

Show lab/tutorial sections

ADMINISTRATIVE

Required Textbook:

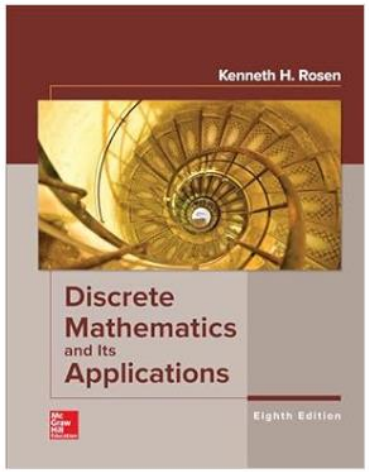
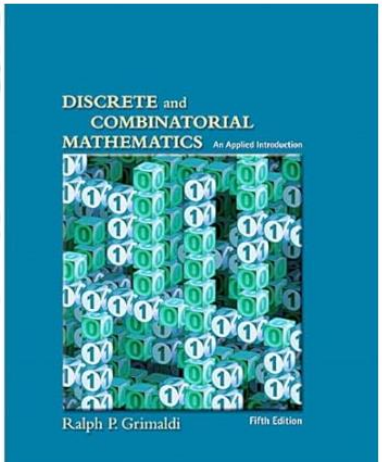


Table of Contents:



Supplementary

ADMINISTRATIVE

Course Website: I no longer maintain a website, as everything is on Canvas.

Always refer to this ADMIN presentation for your tentative schedule of lectures (next slide).

Tentative Course Outline (Rosen-based)

Weeks	Topic	Chapters	Assignments
1	**Introduction and background, elementary logic**	1 and 2	
2	**Elementary logic continued (1.1 – 1.8)**	2	
3	**Set theory, inclusion/exclusion (2.1 – 2.5, 8.5)**	2, 8.5	Assignment 1
4	**Algorithms and functions (3.1 – 3.3)**	3	
5	**Number theory (4.1, 4.3, 4.4)**	4	Assignment 2
6	**MIDTERM #1; Induction and recursion (5.1 – 5.3)**	5	
7	**Combinatorics**	6	Assignment 3
8	**Combinatorics continued (6.1 – 6.6)**	6	
9	**Relations (9.1 – 9.6)**	9	Assignment 4
10	**MIDTERM #2; Graphs and trees (10.1 – 10.2, 11.1 – 11.4)**	10	
11 and 12	**Trees continued and review**	11	

We cover roughly one section per lecture, so please keep up.

FALL TERM (SEPTEMBER-DECEMBER 2024)

September 2	Labour Day University closed
September 3	Welcome Day
September 4	Classes start
September 30	National Day for Truth and Reconciliation All classes cancelled and university closed
October 10-11	Convocation
October 14	Thanksgiving Day All classes cancelled and university closed
October 15	Monday, October 14 classes are rescheduled to Tuesday, October 15; Tuesday classes scheduled for October 15 are cancelled.
November 11	Remembrance Day All classes cancelled and university closed
December 3	Last day of classes
December 5-17	Exams

Grading

- **Homework** - 10%
- **Two Midterms** - 25% each
  - **Midterm #1: Sixth week (Oct. 9)**
  - **Midterm #2: Tenth week (Nov. 6)**
- **Final Examination** (TBA) - 40%

Format of Lectures

- Topics are
  - introduced with PPTs,
  - All PPTs will be posted on Canvas to the class in PDF format.
- The lectures are intended to guide you through the textbook.
- PLEASE READ THE TEXTBOOK.

ADMINISTRATIVE

- All assignments must be completed and handed in for a passing grade.

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ADMINISTRATIVE

- All assignments must be completed and handed in for a passing grade.
- It is the student's responsibility to keep track of his/her performance using courses.cs.sfu.ca.
- Assignments and examinations will be open to review for *one week only*.
- Be aware of the fact that the first midterm date is around the last day to drop classes.
- Plagiarism will result in *harsh penalties*.

Sample Midterms (based on Grimaldi)

SFU – School of Gadget Science
Midterm #1: February 5th, 2014 AD

1) *State* the truth value of each of the following statements to the right of each one (**T**, **F**, or **N** for "no truth value") **[1/2 point each]**:

   a) The number of rows of a truth table scales as 2^n. where n is the number of primitive variables ___
   b) $0 = 1 \rightarrow 1 = 1$. ___
   c) $1 + 1 = \infty$ iff division by zero is undefined. ___
   d) The number, x, is an integer . ___

2) *Prove* that $(q \rightarrow p) \Leftrightarrow (\neg p \rightarrow \neg q)$ both *with* and *without* truth tables. What are these statements called relative to the statement $p \rightarrow q$? **[3]**

3) How many nonnegative integer solutions are there to the pair:

   $$x_1 + x_2 + \ldots + x_7 = 37 \text{ and } x_1 + x_2 + x_3 = 6?$$

   How many solutions above have $x_1, x_2, x_3 > 0$? **[4]**

4) Show that for all positive integers, $n\binom{m+n}{m} = (m+1)\binom{m+n}{m+1}$. **[4]**

5) Prove statement 1b) above algebraically, vacuously, and trivially. **[3]**

6) a) In how many ways can the letters in DATAGRAM be arranged? **[1]**
   b) In the arrangements in a), how many have all three A's together? **[2]**

7) *State* Pascal's formula and *prove* it both combinatorially and algebraically. **[6]**

8) **BONUS QUESTION [2]** Recall Vandermonde's Identity,

   $$\binom{m+n}{r} = \sum_{k=0}^{r} \binom{m}{r-k}\binom{n}{k}.$$

   Prove the corollary

   If n is a nonnegative integer, then

   $$\binom{2n}{n} = \sum_{k=0}^{n} \binom{n}{k}^2.$$

Total=25

SFU – School of Computing Science
Midterm #2: July 10th, 2013

Name: _____

ID: _____

Fill in the blank **[1 point each up to and including problem 8]**:

1. A trivial proof relies upon_____.
2. _____ allows one to prove many of both the laws of logic and the laws of set theory in *pairs* rather than individually.
3. An argument that reasons about more general new knowledge from a small number of given facts or observations is called _____.
4. What rule or rules of inference is mathematical induction based upon?

   _____.
5. A primitive valid argument form is called _____.
6. State the Principle of Inclusion/Exclusion for three sets:

7. The basis step of the inductive proof of the statement of Fibonacci numbers,

   $$f_1 + f_2 + \ldots + f_{2n-1} = f_{2n}, \forall n \in \mathbf{Z}^+$$

   _____.
8. What principle allows one to immediately write down the corresponding Commutative Law for A∪B=B∪A:

   _____.
9. **[6]** Prove the following theorem *a)* **directly**, *b)* **contrapositively**, and *c)* **by contradiction**:

   Theorem: If m is an even integer, then m + 7 is odd.

10. **[1+3]** Let A and B be sets from some universe U. State a quantified definition of $A \subset B$ and then use this to derive a quantified expression for $A \not\subset B$.
11. **[5]** Prove Bernoulli's Inequality; namely:

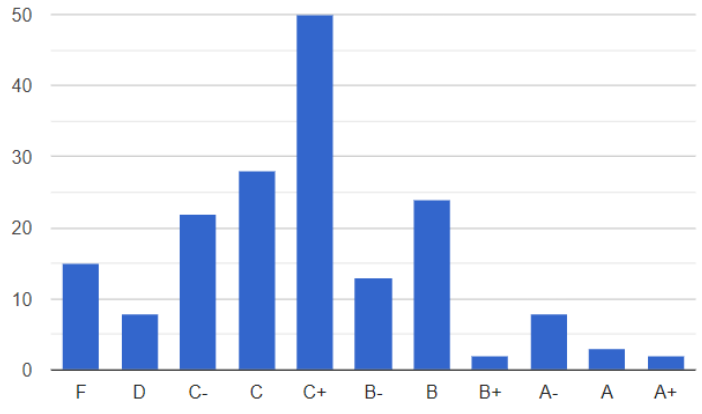
    If $h > -1$, then $(1 + nh) \leq (1 + h)^n$, $\forall n \in \mathbf{N}$

12. **[5]** Prove the Distributive Laws for Set Theory
13. **[2]** Prove the following expression directly without mathematical induction (HINT: consider the first proof done in class)

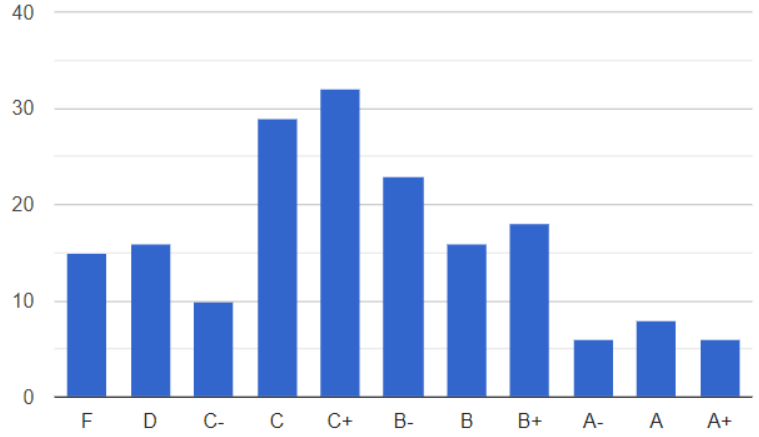
$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

TOTAL POINTS = 30

Grades from Previous Semesters



Pre-COVID, Spring 2018
N = 175



Post-COVID, Fall 2021
N = 179

This is what you can expect. Do not be discouraged. Hard work will and commitment is required. If you do not survive this term, keep trying and you will eventually prevail.

Questions?