



Discrete Structures

Course Name:

Course Code: MATH 181-02

Term: Fall 2026

Credit Hour: 3

Modality: Face to face

Schedule: M-W-F 1:10 am - 2:00 pm

Location: LKH B21



Instructor Information:

Name: Sankar Sitaraman

Email: ssitaraman@howard.edu

Office Location: ASB 219

Office Hours: 3 to 4pm, MWF

This syllabus is subject to change!

Course Syllabus

Course Description:

This course is designed to teach students the fundamental skills of reading and writing mathematical proofs. The journey begins with an introduction to the algebraic theory of sets and propositional logic, including an exploration of arguments and quantifiers.

Building on this foundation, the course will focus on various types of proofs, providing examples to illustrate each method. Students will then study the definitions, types and properties of functions, relations, and sequences. Next, students will be introduced to counting techniques and fundamental principles of combinatorics. The course will then explore essential concepts in graph theory.

If time allows, additional topics may be covered.

Course Objectives: Upon successfully completing the course, learners will be able to:

- Perform operations on sets and analyze their properties.
- Construct truth tables for compound propositions.
- Verify the validity or invalidity of arguments using truth tables.
- Prove the validity of arguments using rules of inference and logical equivalences.
- Apply quantifiers effectively in logical expressions.
- Construct direct and indirect proofs or provide counterexamples for incorrect statements.
- Write proofs using mathematical induction.
- Execute operations on functions and analyze their types.
- Construct and analyze various types of relations, such as partial orders and equivalence relations.
- Distinguish between permutations, combinations, and their generalizations.
- Apply the Pigeonhole Principle to solve problems.
- Understand the types, structures, and properties of graphs.
- Determine whether two graphs are isomorphic.

Detailed outline: We will try to cover material from Chapters 1, 2, 3, 6 and 8 of the textbook. We may cover more if we have time. The topics we will discuss include:

Chapter 1: Sets and Logic

- 1.1 Sets
- 1.2 Propositions
- 1.3 Conditional Propositions and Logical Equivalences
- 1.4 Arguments and Rules of Inference
- 1.5 Quantifiers
- 1.6 Nested Quantifiers

Chapter 2: Proofs

- 2.1 Mathematical Systems, Direct Proofs, and Counterexamples
- 2.2 More Methods of Proof
- 2.4 Mathematical Induction
- 2.5 Strong Form of Induction and the Well-Ordering Principle

Chapter 3: Functions, Sequences, and Relations

- 3.1 Functions
- 3.2 Sequences and Strings
- 3.3 Relations
- 3.4 Equivalence Relations

Chapter 6: Counting Methods and the Pigeonhole Principle

- 6.1 Basic Principles
- 6.2 Permutations and Combinations
- 6.3 Generalized Permutations and Combinations
- 6.7 Binomial Coefficients and Combinatorial Identities
- 6.8 The Pigeonhole Principle

Chapter 8:	Graph Theory
8.1	Introduction
8.2	Paths and cycles
8.5	Representations of graphs
8.6	Isomorphisms of Graphs

Prerequisite(s): MATH 157 (Calculus II): C or better

Please confirm that you meet the course prerequisite by uploading your unofficial transcript to Canvas under Quiz 0

Required Course Materials:

Textbook: Discrete Mathematics, 8th edition, by R. Johnsonbaugh.

Optional/Supplemental Materials: Will be distribute if needed.

Grading and Evaluation: Your grade in the course will be determined as follows:

Quizzes – 40% (every one or two weeks)
 Exam 1 – 20%
 Exam 2 – 20%
 Final Exam – 20%

All quizzes (resp. exams) will receive a numerical grade of 0–10 (resp. 0–100). You will receive a score of 0 for any work not submitted. Your final grade in the course will be a letter grade. Letter grade equivalents for numerical grades are as follows:

Letter Grade Scale
90 – 100
80 – 89
70 – 79
50 – 69
<= 49

To receive credit for the course, you must earn a letter grade of C or higher on the weighted average of all assigned course work (e.g., assignments, discussion postings, projects, etc.). Graduate students must maintain a B average overall to remain in good academic standing.

Attendance and Participation Policy:

All students are expected to attend classes regularly and promptly; attendance will be record for every class. However, attendance is not mandatory. Students are expected to participate in class discussions and group projects. Students should not leave the class while it is in progress unless it

is extremely urgent or an emergency. Students that are absent for health reasons are expected to present documentation as soon as possible. If you are absent from classes or laboratory periods, you are still responsible for the work missed. If you miss a scheduled midterm or final exam, you must obtain your instructor's approval to take a substitute exam or you will receive a grade of zero for the exam.

NOTE: While we will try to stick to the timetable below, the material covered may change depending on how the semester goes.

Course Schedule / Outline			
Week:	Dates:	Lesson Objectives:	Readings <i>If applicable</i>
1	August 17,20,21, 2026	Introductions and discussing course syllabus; 1.1 Sets	§ 1.1
2	August 24, 26,28 2026	1.2 Propositions 1.3 Conditional Statements and Logical Equivalence	§ 1.2 and § 1.3
3	September 2,4,2026	1.4 Arguments & rules of inference 1.5 Quantifiers	§ 1.4 and § 1.5
4	September 7, 9,11 2026	1.6 Nested Quantifiers 2.1 Mathematical systems & direct proof	§ 1.6 and § 2.1
5	September 14,16,18, 2026	2.1 Counterexamples 2.2 More methods of proof	§ 2.1 and § 2.2
6	September 21,23,25 2026	2.2 More methods of proof 2.4 Math Induction Review	§ 2.2 and § 2.4
7	September 28, 30 October 2 2026	2.4 Math induction 3.1 Functions	§ 2.4 and § 3.1
8	October 5,7,9 2026	3.2 Sequences & Strings 3.3 Relations	§ 3.2 and § 3.3

9	October 14,16 2026	3.4 Equivalence Relations 6.1 Basic Counting	§ 3.4 and § 6.1
10	October 19,21,23 2026	6.2 Permutations & Combinations 6.3 Generalized Perms & Combos	§ 6.2 and § 6.3
11	October 26,28,30 2026	6.3 Generalized Perms & Combos 6.7 Binomial Coefficients & Combinatorial Identities	§ 6.3 and § 6.7
12	November 2,4,6 2026	6.7 Binomial Coefficients & Combinatorial Identities 6.8 Pigeonhole Principle Review	§ 6.7 and § 6.8
13	November 9,11,13 2026	8.1 Graph Theory Intro 8.2 Paths & Cycles 8.3 Hamilton Cycles	§ 8.1, § 8.2 and § 8.3
Final	November 16,18,20 2026	8.5 Representations of Graphs 8.6 Isomorphism of Graphs	§ 8.5 and § 8.6
Final	November 23,25 2026	Review	

There will be two in-class **midterms** in the semester.

Midterm 1: Friday, September 25

Midterm 2: Friday, November 6

The **final** will happen after the end of classes, during finals week.

University Statements and Compliance

Math tutoring: There will be free math tutoring to help students who are enrolled in mathematics courses. The Math Tutorial Lab is located in ASB-B room # 109. The hours of the lab will be announced as soon as it is available. The coordinator for math tutoring is Dr. Lifoma Salaam, lifoma.salaam@howard.edu.

Academic Code of Student Conduct (*please see Howard University handbook*): No copying, unauthorized use of calculators, books, or other materials, or changing of answers or other academic dishonesty will be tolerated. Cheating will not be tolerated. Anyone caught cheating will receive an F for the course and may be expelled from the university.

Grievance Procedure: If you have any problems with the policies or rules of this course, discuss your concerns with your instructor. If you are still unable to come to a satisfactory arrangement, you may contact the course coordinator, Dr. Daniel Mamo, daniel.mamo2@howard.edu, if you are still unable to come to a satisfactory arrangement (depending on your status) the Director of Undergraduate Studies, Dr. Jill McGowan, jmcgowan@howard.edu, and then, finally, the Chair of the Department, Dr. Bourama Toni, bourama.toni@howard.edu.

The Americans with Disabilities Act (ADA)

Howard University is committed to creating an accessible, inclusive, and safe learning environment for all students and providing equal access to students with documented disabilities. Students seeking reasonable accommodations must first register with the Office of Student Services (OSS). There you can engage in a confidential conversation about the process for requesting reasonable accommodations in the classroom and clinical settings, which the Office of Student Services (OSS) determines. Accommodations must be requested each semester. Accommodations are not provided retroactively. If you want to request accommodations, please contact Office of Student Accessibility via email at accessibility@howard.edu or visit <https://studentaffairs.howard.edu/Accessibility>

COVID-19 Statement

The indoor mask mandate has been lifted on campus for all faculty, staff, students, and visitors, with a notable exception like patient settings. Faculty may continue to require masks for individual classes. In those classes where a face mask is required, students will be directed to leave the classroom if a face mask is not worn properly to cover the nose and mouth. Any student who refuses or fails to comply with a specific classroom requirement to wear a face mask, and any other measures the University advances for the safety and protection of the Howard Community, will constitute a violation of the University's Student Code of Conduct and could result in sanctions up to and including expulsion from the University.

LGBTQ+

Howard University is committed to providing an educational, living, and working environment that is welcoming, respectful, and inclusive of all members of the University community, including all sexes, sexual orientations, gender expressions, and gender identities. For more information please contact the Division of Student Affairs.

Educational Benefits and Opportunities

No member of the University Community shall deny a student fair access to all educational opportunities and benefits available at the University. To find more information on this policy, please refer to the Code of Ethical Conduct. To report a concern, visit the Office of Student Affairs.

The Family Educational Rights and Privacy Act (FERPA)

It is the policy of Howard University (the “University”) to ensure that information contained within the education records of all students is protected to the fullest extent of the law.

To find more information about this policy visit the FERPA Policy page.

Title IX Statement

Howard University’s *Policy Prohibiting Sex and Gender-Based Discrimination, Sexual Misconduct and Retaliation* (aka, the Title IX Policy) prohibits discrimination, harassment, and violence based on sex, gender, gender expression, gender identity, sexual orientation, pregnancy, or marital status. With the exception of certain employees designated as confidential, note that all Howard University employees – *including all faculty members* – are required to report any information they receive regarding known or suspected prohibited conduct under the Title IX Policy to the Title IX Office (TitleIX@howard.edu or 202-806-2550), regardless of how they learn of it. For *confidential* support and assistance, you may contact the Interpersonal Violence Prevention Program (202-836-1401) or the University Counseling Service (202-806-7540). To learn more about your rights, resources, and options for reporting and/or seeking confidential support services (including additional confidential resources, both on and off campus), visit <https://howard.edu/title-ix>.

University Services

Academic and Student Support Services

For Tutoring Services, visit the Tutoring & Learning Support Services Office.

For Writing assistance, visit the Writing Center.

For Library Services, visit the Howard University Libraries.

For Academic Advising, visit the Academic Advising Services.

For general student academic support, visit the Center for Academic Excellence.

For general student support, visit the Division of Student Affairs.

Technology Support

Enterprise Technology Services:

- For questions about the LMS or third-party tools, visit My Helpdesk and select LMS Support
- For general tech support questions visit My Helpdesk and select Technical Support.
- To contact ETS: **Phone & Email**
Phone: 202-806-2020
Email: huhelpdesk@howard.edu

LMS Support:

- Canvas has 24/7 support via chat or call 1-877-686-8251. To access Canvas Chat, please click on the Help icon in the bottom left-hand corner of your Canvas Dashboard.
- To contact ETS: **Phone & Email**
Phone: 202-806-2020
Email: huhelpdesk@howard.edu

Proctorio Support:

- ETS Proctorio support, visit here for Frequently Asked Questions (FAQs)
- To contact Proctorio: 24/7 technical support to students
Phone at (480) 428-4089 or toll-free (866) 948-9248.

Email support@proctorio.com

Minimum Technology Requirements

In order to make the most of your distance learning experience using the Learning Management System, there are several technical requirements.

Refer to the Guidelines below to help ensure your Distance Learning success:

	Minimum	Recommended
Operating Systems	Windows 10, version 1809 or higher Mac OSX 10.13 or higher	Windows 10 version 2004 or better Mac OS 10.15 or better
Processor	1 GHz processor	2 GHz or faster processor
Memory	512 MB of RAM	2 GB of RAM or higher
Monitor Resolution	1024 x 768	1024 x 768 or higher
Free Hard Disk Space	5 GB of free disk space	20 GB or higher of free space
Internet Connection	Broadband (high-speed) Internet connection with a consistent minimum speed of 1.5 Mbps.	Broadband (high-speed) Internet connection with a speed of 4 Mbps or higher
Internet Browser	Chrome, Edge, Firefox, Safari	Chrome

	Desktop Browser Versions	Mobile Browser Versions
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Chrome²	63+	63+
Edge³	42+	38+
Firefox	57+	57+
Internet Explorer⁴	Unsupported	Unsupported
Safari	12+ (Mac OS only)	With iOS 11+

Category	Tested
Operating Systems	Windows 8, Windows 10, Mac OS 10.12, Mac OS 10.13, Mac OS 10.14, iOS, Android, Windows Mobile, Chrome OS
iOS Devices	iPod Touch, iPhone 4S, iPhone 5S, iPhone5c, iPhone 6, iPad 2, iPad 3, iPad Mini 3, iPad Air 2
Android Devices	Galaxy S4, Galaxy S5, HTC G1, LG C800 myTouch, HTC One, Galaxy Note 2014, HTC One M8
Windows Mobile Devices	Venue 8 Pro, Lumia 520, Lumia 930
Chrome OS Devices	Chromebook (Chrome browser; features requiring NPAPI plug-ins are not supported)

Important!!

JavaScript needs to be enabled in your browser.
To enable JavaScript in your browser [click here](#).

Expected Computer and Digital Information Literacy Skills

The following computer skills and digital information literacy skills expected for this course include:

- Using the learning management system (Canvas)
- Using email
- Uploading and downloading documents, files, etc.
- Using web conferencing tools and software
- Using remote/virtual libraries and databases
- Properly citing information sources

For assistance with these skills please visit Distance Learning for Students Orientation.

How To Be Successful in the Distance Learning Environment

- **Be Disciplined.** Set aside time for your course. Each week you should allow at least five hours of work divided between working on the Canvas platform of our course (reading and answering to postings), reading and conducting research, and completing your written assignments.
- **Follow Directions Carefully and Precisely.** Read the announcements carefully and all course information posted on Canvas. Get acquainted with the communication policy, grade policy, and other requirements for the course. A good idea is to print the syllabus and keep it handy for future reference.
- **Manage Your Time Efficiently.** Work on organizing your time so that you meet all course assignment deadlines. Late work will not be accepted for this course, therefore you are advised to start your papers at least a week BEFORE the due date to allow yourself plenty of time to finish.
- **Access the Course Site Frequently.** Plan to log into the course at least three times a week to read instructor announcements and students' postings in the discussion board. This work does not include the time you must spend writing your assignments.
- **Be Patient.** The course instructors check course emails regularly but may take 24-48 hours to respond to your message.

Distance Learning “Netiquette”

Distance Learning communication lacks verbal and non-verbal cues such as intonation, gestures, stance, and facial expressions that are a regular part of face-to-face communication. The absence of these cues can quickly lead to misunderstandings in the distance learning environment. In order to reduce the occurrence of misunderstandings and to promote a distance learning environment where students feel safe, teachers and students should follow distance learning netiquette.

Watch the following video for Distance Learning Netiquette [click here](#)

The **WRITE** Way to Communicate in the Distance Learning Environment

Lewis' advice about the Write Way to communicate is directed to teachers, but it could easily be adapted for students. "The **WRITE** way involves communicating in a manner that is (**W**)arm, (**R**)esponsive, (**I**)nquisitive, (**T**)entative, and (**E**)mpathetic.

Warmth – "Being warm is a way of reminding others (and you) that it is people who are engaged in communication, not software"

Responsive -- "Try to return personal messages as soon as possible, and set up a regular rhythm of communication for other responses."

Inquisitiveness – "Defensiveness is reduced if people ask questions rather than make statements."

Tentativeness – "A question – framed in a tentative manner – reduces defensiveness and can also contribute valuable information (e.g., 'Don't you think it'd be better if we . . .')." "

Empathy – ". . . put yourself in the shoes of your audience."

Lewis, C., (2000). "Taming the Lions and Tigers and Bears: The WRITE WAY to Communicate Online." In K. Anderson & B. Weight (Eds.), The Online Teaching Guide: A

Handbook of Attitudes, Strategies, and Techniques for the Virtual Classroom (pp. 13-23).
Needham Heights, MA: Allyn and Bacon.

Web Course Policies and Expectations:

Please read these policies carefully and follow them throughout our course.

Web Policy # 1 Use only Standard English

This rule refers to the use of Standard English in all areas of our communication, including e-mails, postings, journals, and blog posts.

If you need to email the course instructors, please use proper salutations and remember to sign your email with your name as it appears in the course roster. Observe *Netiquette* rules and avoid communication errors such as, using only capital letters (i.e. SHOUTING) or all lower-case letters (i.e. informal tone). Use full and proper paragraphs to communicate your ideas. Please access and read the link and file in the previous section (above) to learn more about e-mail netiquette rules.

Web Policy # 2 Discussion forum postings should relate to the course content and specific topic in ways that are substantive and meaningful. Thus, aim for discussion postings that are thoughtful, well developed and that, extend the course discussion in concrete ways. Drawing from helpful outside sources to support your ideas, including relevant examples to illustrate your point and posting thoughtful questions about the readings are all ways of developing your discussion postings.

Aim for initial postings of at least 250 words and responses to others that are at least 75 words. Please avoid posting short responses to others such as, "Great post", "I agree," or "Me too." Instead, think in terms of commenting on specific areas of others' posts. In addition to using fully expressive postings, please remember to always proofread and spell check your work. To do so, click on the ABC check-mark icon on the menu placed on top of the window where you write.

Each week, in order to receive credit for the weekly discussion forums, you must submit an initial post by Wednesday 11:59 (just prior to midnight) and reply to at least two classmates' responses by Sunday 11:59 (just prior to midnight).

Web Policy # 3 No late assignments are accepted for this course.

Distance Learning provides you the flexibility to work when it's convenient for you, but you must show discipline and adhere to the pacing and structure of this course. Since this is not a correspondence course, the timing of assignments, readings, and postings are crucial to the smooth operation and full engagement of this course. Therefore, no exceptions to this rule will be granted.

Communication Policy

- If you have any questions regarding the course, feel free to post them in the **Café forum (faculty must create the forum and can call it whatever forum they chose, e.g. student lounge, etc)** in the Discussion Board (DB). If you know the answer to a posted question, please feel free to respond. In this way, we leverage collective knowledge and participants may receive a quicker answer.
- Use Standard English in all areas of communications. Although many Internet users are accustomed to lower-case writing and abbreviations, our written exchange should reflect the educational setting in which we are operating. Therefore, out of respect for our institution, as well as to model good practices for our distance learners, please use only polished, thoughtful written expression.
- Always use the Spellchecker option of this new version of Canvas which you can find in the menu; it looks like a checkmark that includes the letters ABC.
- Frequency is more important than long stretches of work on the course site. It is important that you interact with regular frequency. Log-on frequently (Monday – Friday) to our Canvas course site. This is what you will expect your student to do as well.
- Do not hesitate to ask questions, give suggestions, or raise an issue during the course. If you feel lost or frustrated, please contact one of the facilitators as soon as possible, and let others help you. Learning to find help is an important learning strategy that should be accomplished / mastered by the end of this course.

Course Components	What you may expect from the facilitators:	What is expected of you:
Email	An instructor will respond to your e-mails within 24 to 48 hours. We often check our email and typically respond promptly. However, please allow an entire business day before emailing again on the same question or issue. Emails sent on Saturday or Sunday will receive a reply by Monday or Tuesday. Please do not expect to receive returned email from your instructor on Saturdays or Sundays.	If you have a personal question, please send an email. Questions regarding the course content should be posted in the discussion forum titled – Café. Please sign all your emails with your full name.
Phone	You are welcome to call your instructors, although our preferred communication is through email. If it is a matter of solving a technology question, please email the helpdesk at helpdesk@howard.edu . Please be aware that your instructors are not available to return or receive your calls on Saturdays or Sundays.	If you do not receive a response follow up. Be sure to check your emails to ensure you are responsive should the helpdesk have questions. Include your full name, name of the course, name of the instructor and a clear description of your issue. Provide a good contact number should they need to call you back.

Announcements	We will post new announcements to alert you of any new happenings in our course, or the lab.	Read the announcements for any new updates and the important notices from the facilitators.
Virtual Office Hours	We will be available to make an appointment with you should you require additional assistance outside of our established lab sessions. Please be aware that it will be imperative to email us to set up an appointment time and we will be available virtually.	Contact the facilitators of this course to set up additional time to meet as well be prepared to utilize the Canvas Collaborate or the designated web conferencing medium selected feature in order to access us virtually during your appointed time.

Privacy Policies

Adobe
 Canvas
 Echo 360
 Flickr
 McGraw Hill Campus & Higher Education
 Microsoft
 Pearson My Lab & Mastering
 Poll Everywhere
 Proctorio
 SlideShare
 Wiley Course Resources & Wiley Plus
 YouTube