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MTH 325: Discrete Structures: Computer Science 2

Fall 2020

Course Information

Class meetings

Section 01: Online with synchronous meeting on Wednesdays 9:00-9:50am
Section 02: Online with synchronous meeting on Wednesdays 11:00-11:50am
(see optional meetings)

Textbook

Discrete Mathematics: An Open Introduction by Oscar Levin, Available for free:

- http://discretetext.oscarlevin.com/dmoi/ (interactive online version)
- http://discretetext.oscarlevin.com/download.php (pdf version)
-

Course Description

We will study properties of relations, equivalence relations, partial orderings, fundamental concepts of graphs, trees, digraphs, networks, and associated algorithms; including computer science applications.

Prerequisites: MTH 225

Class materials

All class materials will be posted to Blackboard: http://mybb.gvsu.edu

Please check Blackboard and your GVSU email regularly for class updates and information.

Learning Objectives

After successful completion of the course, students will be able to…
1. Compute basic information about graphs, relations, and trees.
2. Solve theoretical and applied problems involving applications of basic concepts of graphs, relations, and trees.
3. Formulate computational problems in terms of graphs, relations, and trees.
4. Construct a logical framework for a proof using mathematical induction, direct proof, proof by contraposition, or proof by contradiction.
5. Analyze the structure and validity of a mathematical proof.
6. Employ effective problem-solving skills in solving computational problems.
7. Explain methods and solutions of computational problems in a clear way to a specified target audience.
8. Demonstrate fluency in applying algorithms in the formulation and solutions of mathematical problems.
9. Assess one's own work in mathematical problem solving and apply feedback to make improvements to one's own work.

Optional meetings.
Section 01: There are optional synchronous meetings on Mondays & Fridays, 9:00-9:50am.
Section 02: There are optional synchronous meetings on Mondays & Fridays, 11:00-11:50am

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What technology will I need?

- Please bring with you to each class meeting a **laptop** or **tablet**, preferably with a **touch screen** and **stylus** so that you can write on the screen.
- You will need the ability to scan documents to a PDF (using a smartphone, tablet, scanner, etc.).
- Since this is an online course, you will need **reliable access to high-speed internet**.
- You will need an active GVSU network account, so that you can access the course Blackboard, check your email, and access Google Docs, Sheets, Slides, etc.
- We will be using **Zoom** video conferencing for virtual class meetings and office hours, see the GVSU Zoom Business Plan for information about setting up your account.

Instructor information

Instructor: Dr. Taylor Short (call me Taylor!)
Preferred pronouns: he/him/his
Office: B-2-204 MAK
email: shorttay@gvsu.edu (best way to contact me; see email hours[1])
Office phone: 616-331-8545
Open office time via Zoom: Mondays, Wednesdays, and Thursdays from 2:00-2:50pm via Zoom, or email me to schedule an appointment.
Website: http://sites.google.com/view/taylorshort/
Hobbies outside of work: playing basketball, watching sports, cooking, eating, and traveling

[1] **Email hours.** You can email me at any time, however, I only check email on weekdays between 8:00am and 5:00pm. If you email me outside of these times, I will respond when I'm back online.

Why am I in this course?

A fundamental part of this course is *reading and writing proofs.* Writing a proof gives us a framework for convincing other people you are correct. Being able to read and evaluate a proof allows us to determine when other people are right. Think about how these skills will translate to your job one day: being able to explain to your colleagues that your idea works; or being able to analyze and evaluate someone else's work. Learning how to read and write proofs will require you to work on your skills involving: logical thinking, abstraction, finding patterns, creativity, problem solving, and communication. These skills are not only key for your future career but also for your day-to-day lives in the modern world!

You will also learn about three central tools for computer science: graphs, relations, and trees. This work will build upon what you did in the prequel to this course, MTH 225, and give you methods for tackling problems in computer science.

What will this course be like?

I firmly believe the best way to learn something is to do it, and this idea applied to learning mathematics is supported by A LOT of research. Think about if you play a sport, an instrument, or have another hobby that you do regularly; how did you learn to do this?

With this idea in mind, we will spend the majority of our time doing mathematics - instead of passively watching lectures and taking notes. You will prepare for each lesson by doing some reading, watching an occasional video, and answering some questions about fundamental ideas. From here, you will be more prepared to gain a deeper understanding of the material. As you proceed further into each lesson, you will work actively on new ideas and content - with the help of the book, your classmates, and me.

How do I succeed?

1. **Take responsibility**. You need to take responsibility for your own learning. Learning is not memorization or mimicking examples. You will be expected to work and construct your own understanding with help from the book, your classmates, and me.
2. **Work hard**. Learning does not come easy. There are no shortcuts. In fact, research shows the easier it is to learn something, the quicker you forget it. You will be confused, struggle, and fail many times throughout the learning process, but do not get discouraged, embrace it. If you need motivation, just listen to the greatest basketball player of all time: http://gvsu.edu/s/0MV (no, it's not Lebron…).
3. **Reflection**. At the conclusion of this course, I want you to be better than when you started. In order to improve at anything, you must reflect on your experiences by asking questions like "What went well?", "What went wrong?", "How can I improve?".
4. **Demonstrate mastery**. Taking responsibility for your learning, working hard, and reflection are all important, but they're not enough. Eventually, you must master the important ideas in this class and demonstrate this to me.

What assignments will there be?

This course was originally planned as a Monday/Wednesday/Friday course. To maintain a regular schedule, **assignments for this course will generally be due on a Monday, Wednesday, or Friday** (though you will have time to complete assignments in advance on days other than these).

- **Activities**.
    - **Preview Activities**. To begin each lesson, you will complete some questions to help better prepare you for the lesson's main ideas. These questions will usually be based on some reading or an occasional video and will be distributed and submitted using Desmos. Preview Activities will be due by 8:00am on Mondays, Wednesdays, and Fridays. You will have the opportunity to receive feedback on your progress in the Preview Activities before you proceed to the main activity of the lesson, so that you can check you are progressing in a good direction. **There will be around 27 Preview Activities throughout the semester.**

    - **Lesson Activities**. You will work through the main ideas of each lesson actively. These activities are usually written exercises or questions that build upon your work on the Preview Activities. I will provide solutions to each activity so that you can check your understanding at the conclusion of each lesson. **There will be around 27 Lesson Activities throughout the semester.**

- **Learning Targets**. The course is broken down into Learning Targets, which represent the basic skills you should have by the end of the course. You will have regular Checkpoints, which are take home assignments containing questions for the Learning Targets covered up to that point in the course. You will be able to a certain number of Learning Targets each Checkpoint and attempt to demonstrate mastery of these skills. There will be a 24 hour window to work on and submit each Checkpoint. **You will have 5 Checkpoints throughout the semester, tentatively scheduled for Weeks 3, 6, 9, 12, and 15.**

While learning targets represent the basic skills of the course, the two assignment types below are your opportunity to display your advanced problem solving skills and professional communication. You might even be asked to learn something outside of class. These assignments are not meant to be completed in one sitting. Instead, you should work on these assignments regularly.

- **Proof Portfolio**. You will write up professional quality proofs in a portfolio. Working on this assignment will build your problem solving skills, assess your work at writing and presenting a convincing argument, and showcase your progress and mastery throughout the semester. **There will be 5 Proof Portfolio assignments during the semester.**

- **Programming.** In this assignment you will apply content from the course to solve a question using the Python programming language. **There will be 3 Programming assignments during the semester.**

- **Final Exam**. Your “final exam” will be your 6th and final Checkpoint scheduled for the week of final exams, Dec. 14-18. This will be your last opportunity to demonstrate mastery of the Learning Targets. You may attempt as many Learning Targets on the final Checkpoint as you wish. There will be a 48 hour window to work on and submit this last Checkpoint.

How will I be graded?

We are using mastery-based grading in this course. In short, this means you only receive credit for correct responses, but you get multiple chances throughout the semester to display mastery.

While this system may be new to you, it has advantages. In general, learning happens over time. This system measures how well you eventually understand the course content. You can make mistakes without penalty, as long as you eventually demonstrate mastery of the topic. Hopefully, this alleviates some of the stress you’d experience during a normal “exam” (note that we do not have exams in this course). This also allows you to reflect and learn from your previous work (after all, when you are learning how often do you do something correctly on your first try?)

There are no points in this system, instead you will receive one of three grades: **S for Successful**, **G for Growing**, or **N for Not yet**. These grades are detailed in the following rubric:

<table>
<tr><th colspan="3">Does this work demonstrate a thorough understanding of the concept?
and
Does this work meet the expectations outlined in the assignment?</th></tr>
<tr><td>Yes</td><td colspan="2">No</td></tr>
<tr><td></td><td colspan="2">Is there evidence of progress or partial understanding?</td></tr>
<tr><td></td><td>Yes</td><td>No</td></tr>
<tr><td>S: Successful

Demonstrates full understanding of the concept(s) with correct reasoning and explanation. May include minor errors but no additional study or review is needed.</td><td>G: Growing

Demonstrates partial understanding. Well on your way to mastery but significant gap(s) remain. Gaps include but are not limited to: major math errors, incomplete work, or unclear communication or reasoning that leaves understanding in doubt.</td><td>N: Not yet

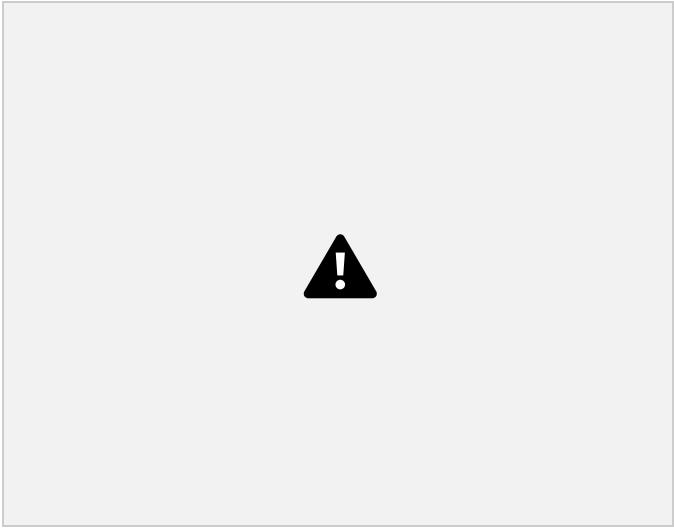
Fragmentary or no response. Insubstantial attempt made, major omission, or too many errors to correct each individually. Need to carefully restudy and redo from the beginning.</td></tr>
</table>

How will my final grade be determined?

For your overall letter grade, the following percentages are required:

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Percentage	93%	90%	87%	83%	80%	77%	73%	70%	67%	63%	<63%

Your final grade will be determined according to the percentages in the chart:



- **Preview Activities**. Will be graded solely based on effort and completion with an S for Satisfactory or a U for Unsatisfactory. Your overall Preview Activity grade will be based on the percentage of activities you Satisfactorily complete throughout the semester.

- **Learning Targets**. Will be graded for mastery using the grades S, G, and N. Only a grade of S earns you credit. Once you obtain an S, you receive full credit for that Learning Target and you need not attempt it again. Your overall Learning Target grade will be based on the percentage of Learning Targets you Successfully complete throughout the semester.

- **Proof Portfolio**. Will be graded for mastery using the grades S, G, and N. Only a grade of S earns you credit. Your overall Proof Portfolio grade will be based on the percentage of Portfolio problems you Successfully complete throughout the semester.

- **Programming**. Will be graded for mastery using the grades S, G, and N. Only a grade of S earns you credit. Your overall Programming grade will be based on the number of assignments you Successfully complete throughout the semester, as detailed in the table below. Demonstrating successful completion of the Codeacademy course will raise your programming grade by 10%, up to a maximum of 100%. See below for sample grade calculations.

Successful Assignments	Programming grade
3	100%
2	75%
1	60%
0	0%

So for example, if you complete the Codeacademy course and earn an S on two assignments, your overall programming grade will be 85%. Note that completion of the Codeacademy course and an S on all three assignments earns a Programming grade of 100%.

How do revisions work?

All revisions are scheduled on a weekly basis. For the purposes of this class, a week begins at 12:00 am Eastern Time on Mondays and ends at 11:59 pm Eastern Time the following Sunday.

- **Proof portfolio**. Any such assignment may be revised to raise the grade received, and the revision will be graded based on the same criteria as the original submission. To revise such an assignment, create a new version and submit using the same methods as your original submission.
    - You may revise one such assignment in a given week. A second item may be revised by spending a token (explained below in the token section of this syllabus).
    - If you miss the initial deadline for an assignment, you must wait until at least the following week (i.e. the following Monday) and use one of your revisions to turn it in.
    - The first two revisions of such an assignment may be done without penalty. All subsequent revisions will cost one token. This policy is put in place to encourage the pursuit of excellence, as opposed to repeatedly turning in work just to get feedback.
    - **All revisions are due by Sunday, December 13 at 11:59pm**.

- **Learning Targets**. You may revise any previous Learning Target on a future Checkpoint.
    - You may attempt a Learning Target as many times as you need. Once a Learning Target has been attempted three times without mastery, you must meet with me before attempting the Learning Target again. If you do not meet with me prior to retaking the Learning Target, then your work will not be graded.
    - Learning Targets returned with a grade marked, P*, means that this Learning Target is eligible for a “Quick Fix” and you and I will need to meet to discuss this further. At this meeting you should be prepared to demonstrate that you understand the Learning Target and doing so successfully will change your grade to an M. Demonstrating your understanding will go beyond simply correcting your previous work and likely will involve additional questions from me, so be prepared for a discussion. If you are unsuccessful in demonstrating understanding or you do not meet with me within one week of returning the Learning Target, your grade will revert to a P.

- **Programming**. Any such assignment may be revised and resubmitted as many times as needed. To revise such an assignment, create a new version and submit using the same methods as your original submission. There are no restrictions on revisions of programming assignments, except that **all revisions are due by Sunday, December 13 at 11:59pm**.

What the heck are Tokens?

Tokens are fake currency we use to buy opportunities and exceptions to course rules. These can help you deal with unexpected events, problems, or if you just have a busy week - because hey, we are all human and sometimes life happens!

- You will start the semester with 5 tokens.
- To spend a token, use the Token Spending Form in the Token section on Blackboard.
- You may not barter or trade tokens with classmates.
- There *might* be opportunities to earn additional tokens as the semester progresses. More details on this will follow.
- The following table designates how you may spend a token, with no exceptions to these rules:

Purpose	**Token Cost**
48-hour deadline extension on an assignment **(cannot be used for Checkpoints).**	1
Third or subsequent revision of an assignment.	1
Resubmit one additional assignment in a given week.	1

Additional restrictions on token use:

- Only one token per week may be spent to resubmit an additional assignment in a given week.
- Spent tokens do not change the definition of a week. The end of a week is still 11:59 pm Eastern Time on Sundays.
- Tokens spent on a 48-hour deadline extension only extend the original deadline of the assignment by 48 hours — not 48 hours from the time the token was spent.
- Tokens that are requested will be deducted from your total whether or not you end up using them. For example, if you request a token for a deadline extension and then do not turn in the work at all, you will still be charged a token.

Are there other course policies?

This course is subject to the GVSU policies listed at http://www.gvsu.edu/coursepolicies/.

- **Extra Help**. Do not hesitate to sign up for open office hours or email me to schedule an appointment to discuss any aspect of the course. I want you to succeed!

- **The Writing Center**. The Fred Meijer Center for Writing provides writing assistance to all GVSU students, on any type of project and at any stage of the process. The Writing Center employs both undergraduate and graduate writing consultants from across majors and disciplines. Consultants are trained to help writers brainstorm, organize, or develop their ideas; and they can help writers edit their own work and document sources correctly. The Center's services are free and students can work with an idea, assignment prompt, or draft of their paper. Students can virtually drop in or schedule an appointment; both appointments and drop-ins are available during all service hours: (Mon-Thurs 9am-11pm, Friday 9am-3pm, Sunday 2pm-11pm).

  Due to COVID-19, all writing center services are available online. Limited in-person consulting may be available; please check the Writing Center's website for up-to-date information. All service options (drop-ins, appointments, email support) can be accessed via the Writing Center's online scheduling system - Book It. We look forward to working with you!

- **Student Concerns**. If there is any student in this class who has special needs because of learning, physical or other disability, please contact me and Disability Support Services (DSR) at 616-331-2490 or online at http://www.gvsu.edu/dsr. Furthermore, if you have a disability and think you will need assistance evacuating this classroom and/or building in an emergency situation, please make me aware so that the university can develop a plan to assist you.

- **Religious Exemption**. In accordance with the Religious Inclusion Policy, GVSU will provide reasonable accommodations for faculty, staff, and students to observe their religious beliefs, except where accommodating the request would result in undue hardship on the University in its mission, operation or in meeting its academic standards. If you would like to request a reasonable accommodation, please complete this form and submit it to me within the first two weeks of class.

- **Emergencies**. Immediately proceed to the nearest exit during a fire alarm. Do not use the elevator. See http://www.gvsu.edu/emergency for additional emergency information.

- **Class Recordings**. Video and audio recordings of class lectures will be part of the classroom activity. The video and audio recording is used for educational use/purposes and may be made available to all students presently enrolled in the course. Students do not have the right to record classroom lectures and discussions without securing prior permission from the course instructor. If you have a documented learning or physical disability and need such electronic assistance, reach out to the instructor well ahead of

time to arrange appropriate accommodations in coordination with the instructor and the Disability Support Resources office.

- **Face Coverings**. Face coverings, such as masks, are required to be worn in the classroom. Students who have forgotten their face coverings may get a disposable mask at a campus office. The evidence is clear that face coverings are a crucial part of keeping coronavirus at bay and support the university's commitment to providing all members of its community with an inclusive living and learning environment with equitable opportunities for success. GVSU's policy on face coverings is posted on the Lakers Together web site. Students who are not able to wear a face covering due to a medical condition should contact Disability Support Services (DSR) to discuss their individual situation.

- **Changes to this syllabus**. I reserve the right to make any necessary modifications to the expectations and plans set forth in this syllabus. If I make any changes, they will be clearly communicated to you and an updated version of this document will be posted.