MTH 225-02, Fall 2020 Syllabus

START HERE

Welcome to Discrete Structures! I'm Robert Talbert, Professor of Mathematics, and I am grateful that you are signed up for the course and am looking forward to working with you this semester. Before reading any further, here are some first things to know:

1. **I want you to succeed**. Your intellectual growth is my primary priority and responsibility this semester. I am committed to working with you to help you learn, to make sure you're not just surviving but thriving in our class and having productive, positive experiences with fascinating ideas that lead to a lifetime of further learning in this subject.
2. **Success doesn't come easy.** "Success" means more than just good grades. It involves being challenged intellectually and being regularly pushed out of your comfort zone and not settling for less than your best work. It also takes active, intentional participation even when it's difficult to get motivated. And, the pandemic is making everything harder than it needs to be. Make no mistake, you'll be working **hard** in MTH 225.
3. **But the struggle is normal and healthy.** When you're exercising to get physically stronger, the most explosive growth happens at the moment that you are struggling the hardest and you might feel you can't go any further. The same is true for getting mentally stronger. Your earlier math courses might have been easy for you, and so for you, struggle feels like you're doing something wrong. **This is not the case. Struggle is actually a sign you're doing things right.**
4. **Every facet of this course is built to give you support when you are challenged, and every person in the course has your back.** Throughout the semester, you will be challenged but also given a lot of support to help you rise to the challenge. I will be readily available to help in several channels; your classmates will be available for help through structured and informal support groups; and the GVSU Math Department provides free help through the Math Center. There are people there to help every step of the way.

I am really looking forward to working with you in this course. It won't always be easy, but if we work together and stay focused, you'll learn an amazing amount and have a great experience.

Course Information

Instructor: Robert Talbert, Ph.D., Professor of Mathematics. Email: talbertr@gvsu.edu. Phone: 616.331.8968.

Office: My office is **Mackinac Hall C-2-513**. However, all student meetings this semester will be conducted online unless you have a specific need that requires a physical meeting.

Drop-in hours: Monday through Thursday, 1-1:50pm on Zoom, using the link http://gvsu.edu/s/1qX and

password **growthmind**. **You do not need an appointment; just click the link.** If you cannot attend drop-in hours, you can contact me by email, through a Campuswire direct message, or by scheduling an appointment at http://rtalbert.youcanbook.me.

Availability: I typically only check email and other messages between 6am and 6pm on weekdays and once on Saturday mornings. If you send a message that needs a response during those times, you can expect to get a response within 6 hours. Otherwise you can expect one when I am back online.

Meetings: 12:00-12:50pm MWF with face-to-face meetings on Mondays and Wednesdays in Mackinac Hall B-1-132. This course uses a *synchronous staggered hybrid* model in which the class is split into two groups (**Red** and **Blue**) and the groups alternate attending class face-to-face (F2F) and synchronously online on Mondays and Wednesdays, and the entire class meets together synchronously online on Fridays:

Day	Who is F2F?	Who is online?
Monday	Red	Blue
Wednesday	Blue	Red
Friday	Nobody	Everybody

Note that **all students are expected to participate in all meetings**; if it is not your group's designated F2F day, you'll participate synchronously online. You are not to skip class when it's not your day to meet F2F, and please do not schedule work or other classes on the days you're not meeting F2F.

Textbook: Discrete Mathematics: An Open Introduction by Oscar Levin, which is available for free online at the link. If you prefer a paper copy, here are instructions on how to purchase a printed copy. The book is not sold in the GVSU bookstore. Please note, this book does not cover all the content in the course; content not found in the textbook will use homemade notes.

Course website and discussion board: All course announcements, assignments, and grades will be communicated using the course **Blackboard** site available at http://mybb.gvsu.edu All other course communications (including additional examples, guidance on assignments, etc.) will be available through **Campuswire**, our class discussion tool; to join, go to http://www.campuswire.com and use the code `0540`.

GitHub: All finalized course materials will be posted to Blackboard; but materials, works in progress, and notes for this course, along with an archive of materials from past MTH 225 and MTH 325 courses, are also curated at the (public) GitHub repository https://github.com/RobertTalbert/discretecs. Feel free to clone or fork.

Course calendar: A Google Calendar, will all due dates and other important time-sensitive information posted on it, is available on Blackboard in the left sidebar. **Be sure to check the calendar once daily** for upcoming events. The calendar is kept up-to-date constantly and **in cases of apparent conflicts in times or dates, the calendar is considered to be correct always.**

Definition of "Week": Quite often we'll refer to a "week" as a unit of time in the course. For us, a "week" is *the period of time starting at 12:01am Eastern on Monday and ending at 11:59pm Eastern the following Sunday*.

Technology: GVSU students taking online and hybrid courses are expected to possess a baseline of technological skills and equipment. Click here to read the full list of expectations. For our course specifically, you will need to have access to the following:

- **A laptop or tablet device**, preferably one with a **touchscreen that allows writing on the screen with a stylus**. Please plan on bringing this device with you to all F2F meetings.
- **A modern web browser**. Chrome is preferred, but browsers such as Firefox and Edge are also fine.
- **Reliable access to high-speed internet**.
- **An active GVSU network account** so that you can access email, Blackboard, and Google Docs.

If you have any issue with accessing any of the above, please let me know as soon as possible.

Student communication expectations: Due to the hybrid format of the course and the unpredictable, fast-changing pandemic situation, it is imperative that you maintain awareness of course announcements and other communications. **Each student is expected to check their email, Blackboard announcements, Campuswire posts, and the course calendar at least once per day and preferably more than once.** All important information will be pushed to you as soon as possible; it's your responsibility to check messages regularly and act on the information. *"I didn't see the announcement"* will not be accepted as an excuse!

Important modifications to the calendar: Please note that, in keeping with an announcement from the Provost and President in August: *the course will be entirely online after Thanksgiving Break*, from Monday November 30 through the end of the semester. Also, *Fall Break is cancelled*, although we will have no course activities scheduled for the days Fall Break occupied. Finally, **the withdrawal deadline has been extended to November 20, 5:00pm** and **the deadline to declare Credit/No Credit has been extended to September 11, 5:00pm**.

What Discrete Structures is about

Discrete mathematics refers to the study of structures that can be **separated and counted**. The word "discrete" is the opposite of "continuous", which refers to things that flow together and cannot be easily separated. Think about American football versus soccer. Whereas the gameplay in soccer is mostly *continuous*, with the ball flowing across the pitch and between teams without breaks, gameplay in American football is *discrete* with each side taking turns that are clearly separate and can be counted. Since computers do not operate on continuous flows of information but rather through discrete packets, processed using algorithms that have discrete steps, discrete mathematics is the foundation for *everything* in computer science. By studying discrete structures, you'll gain a foundation for understanding computing that applies to *any* hardware and *any* software, including those that haven't been invented yet!

Course content: Key topics in the course will include different modes of representation of integers (whole numbers), binary and modular arithmetic, symbolic logic, set theory, functions, counting techniques, recursion and induction, and the basics of mathematical proof. In every topic, we seek a **conceptual understanding** from several perspectives, the ability to **apply ideas**, development of **logical reasoning and communication skills**, and an **appreciation for Discrete Structures as a whole**.

Official course description: . Logic, sets, counting techniques, cardinality, relations, functions and sequences, matrices, mathematical induction, and computer science applications. Please see the

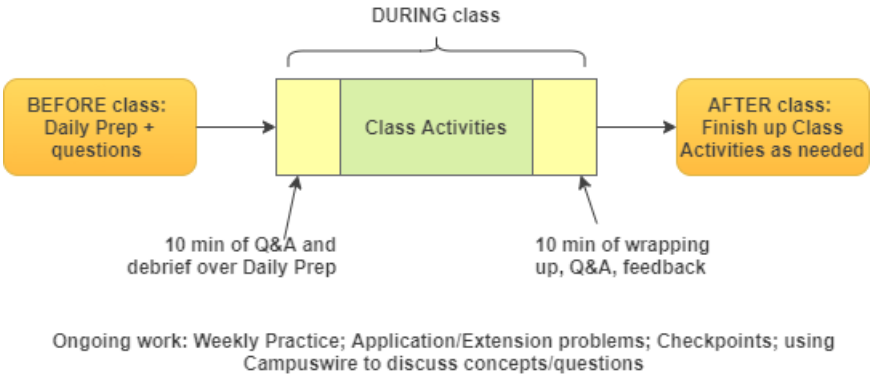
mathematics program for placement details. Offered fall and winter semesters. *Prerequisite*: MTH 122 or MTH 123 or MTH 124 or MTH 201 or assignment through Grand Valley math placement.

Schedule and flow of course activities

Default class workflow

The course content in MTH 225 is split up into 12 **modules**. Each module occupies three class days (often, but not always, starting on a Monday). For the first two days of that stretch of time, regardless of whether you are meeting with the class F2F or synchronously online, your work in the class will follow a pattern that will involve you **before**, **during**, and **after** our meetings:

- **BEFORE each class**: You'll complete a **Daily Prep** assignment in which you'll get familiar with the basic concepts of the upcoming lesson. Daily Prep assignments will typically be due by 11:59pm ET the night before the lesson; you'll be able to work ahead if you want.
- **DURING each class**: Class meetings will typically start with 10 minutes for going over the Daily Prep assignments and fielding questions. Then we will spend around 30 minutes doing **Class Activities** together on the harder concepts from the material. **Lectures on the material will be infrequent and short**; you'll watch longer lectures prior to class in your Daily Prep. Then we will typically spend 10 minutes wrapping up, going through some of the main points of the activity, taking short ungraded quizzes to give you feedback on your learning, and getting your feedback on the lesson.
- **AFTER each class**: If you don't complete the Class Activities in class, you'll need to finish them at home, then turn them in. There are also recurring assignments described later in this document that take place outside of class meetings that you'll be doing.



The third/final day of each module is set aside for additional practice, question/answer sessions, and wrapping up the module.

Online participation options

You should plan on following the default setup above for course participation. However, to give you maximum flexibility and choice for how to interact with the course, **any student may choose to opt out of their designated F2F meeting and choose synchronous online participation instead, at any time — no**

questions asked, no permission needed, no penalities incurred. You may exercise this option for example if you are feeling sick, if you have responsibilities to family that make F2F attendance difficult, or if you have Covid-19 related concerns about being on campus in a room with 14-15 other people. **You do not need prior approval to attend online; just show up in the live stream**.

Furthermore, if you cannot attend F2F or choose not to attend F2F, and synchronous online participation is an issue (because of access to reliable internet, significant illness, etc.) then **asynchronous versions of the daily Class Activities will also be available**, allowing you to complete the class activities on your own schedule (subject to a deadline). As with the synchronous online option, **any student may choose the asynchronous option at any time — no questions asked, no permission needed, no penalities incurred.**

It's therefore possible for you to complete the entire course without attending a single F2F meeting, or even a single synchronous online meeting, if you use these options repeatedly. All I ask is that you get your work done, do it well, and participate actively in the course learning community in some way, whether through F2F interaction, synchronous online interaction, or asynchronous online interaction via Campuswire discussions.

That said, **it is likely that you'll struggle to make progress with the class unless you attend F2F or synchronously much of the time**. Many students report that they need the structure of fixed, live meetings to keep them on track. So please plan on *not* using the asynchronous option unless you have a good reason.

Your learning activities for the course

The learning activities for the course cover three basic areas of learning: *basic skills*, *applications* of those basic skills, and *engagement* in the learning community of the course. Here are the categories of work you'll be doing:

- **Daily Preparation (DP)**: You will complete these before each of your F2F meetings. Each Daily Prep assignment involves reading, video-watching, or interaction and then working exercises on basic learning objectives.
- **Class Activities (CA)**: At the heart of your learning experience in MTH 225 are the Class Activities where you will actively build your understanding of essential ideas. These will occupy at least 30 minutes of each meeting and will be turned in on Blackboard following class meetings. If you attend F2F or online, you should be able to complete most or all of the Class Activities during class, then just upload your work later. If you are participating asynchronously, you'll need to budget time for these, and you'll also be asked to complete some extra work that the F2F/synchronous participants don't have to do.
- **Learning Target Checks**: A major part of the course is your demonstrating progress toward the 22 different **Learning Targets**, found at the end of this syllabus. To demonstrate your knowledge of a Learning Target, you'll do work to earn a "check" on that Target. Later in the syllabus, we'll describe four different ways to do this.
- **Application/Extension Problems (AEPs)**: AEPs are sets of problems that lead you through applications of the basic skills of the course to solving real-world problems or extensions of the ideas in those skills. These frequently involve using technology to build models or programs, and then using

discrete math concepts with those models to draw useful conclusions.
- **Weekly Practice (WP)**: In a typical week, you will be given a set of exercises that give further practice on the week's concepts. These are to be done individually, written up, and turned in on Blackboard. They are graded using the "EMRN" rubric described later in this syllabus.
- **Engagement Credits (EC)**: Various other activities in the class will give you the opportunity to get and stay engaged with the course. These include the Startup assignment in week 1, occasional discussion board activities, meeting certain incentive bonus deadlines, and other items. Designated items will carry 1 "engagement credit", and engagement credits will accumulate through the semester. In particular, **every Daily Prep and Class Activity is worth 1 engagement credit**.

We will also have a **Final Exam** consisting of two parts. The first part consists of big-picture questions on the overall ideas of the course and an opportunity to show that you have satisfied the three "CS" learning objectives (see Appendix). Your performance on this part contributes to the plus/minus grade in the course. The other part of the final exam will be a last Checkpoint of the semester and will give you the chance to meet additional learning targets that have not yet been mastered. The Final Exam will be done asynchronously and will be assigned on Wednesday, December 16 and due on Friday, December 18.

How your work is graded

Our course uses a **mastery-based grading system** in which **most graded work does not have a point value** but is instead graded on the basis of **whether or not it meets standards of acceptable work or not**. When you submit most work, I will evaluate it relative to those standards (which will be publicized in advance) and if your work doesn't meet the standard, you'll be given feedback on it and then a chance to redo it. So very little in the course is ever "one and done"; your grade in the course instead will be based on what you *eventually* learn.

How Learning Targets are graded

There are 22 Learning Targets in the course, which together form an outline of all the important concepts in the course. Ten (10) of these are designated as **Core** targets due to their central nature in the course, and the other 12 are designated as **Supplemental**.

An important goal for you in the course is to **demonstrate proficiency, and eventually mastery, of all the Core targets and as many of the Supplemental targets as you can.** Accordingly, there are two levels of achievement on the Learning Targets: **Proficiency** and **Mastery**. Each time you provide a piece of evidence that shows you know how to perform the task in a Learning Target, you will earn a "check" on that Learning Target. **Earning one check on a Learning Target gives puts you at "Proficiency" level on that Target. Earning *two* checks puts you at "Mastery" level.**

You can earn a check on a Learning Target in **four different ways**:

1. By **completing a problem on a Checkpoint** that pertains to that Learning Target. A *Checkpoint* is a take-home exam given every 1-2 weeks (see the calendar for dates) that contains one (sometimes multi-part) problem per Learning Target that has been covered in class activities up to that point.

Checkpoint are cumulative, so each one contains new versions of all the problems from previous Checkpoints, plus new problems for newly-covered Learning Targets. This way, if you do work on a problem that doesn't meet the standard for acceptable work, you can redo it later.

2. By **scheduling an oral exam** (through Zoom/Google Meet) during which you'll be given a problem similar to one on a Checkpoint for the Learning Target, and completing the problem satisfactorily along with followup questions I may ask.
3. By **creating a video** of yourself in which you work out the solution to a problem similar to one on a Checkpoint for the Learning Target (that I will provide), then submitting that video and answering followup questions via a video meeting.
4. By **using work on an AEP** that, in your view, shows evidence that you know how to perform the task on a Learning Target. In this option, you'll schedule a video interview with me and make the case for your work, and I'll listen and then ask some followup questions that you'll need to address.

Most students earn most of their checks through Checkpoints rather than the three alternatives, but you should feel free to use different options to see if one works better for you than others. However, please note some important restrictions:

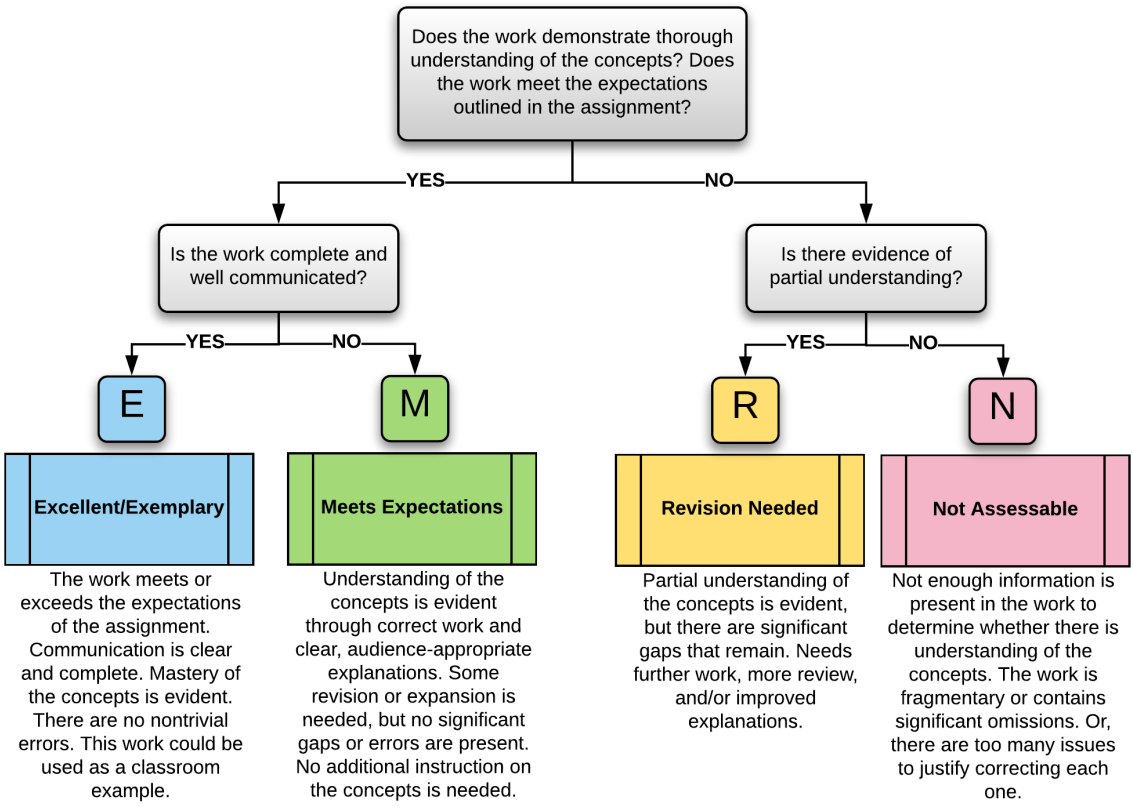
- To earn Mastery level on a Learning Target, *at least one of your two checks must be earned through a Checkpoint or through an oral exam*.
- *No more than one oral exam, one video, or one AEP can be used in a given week to earn a check*. (To prevent a student from scheduling 18-20 oral exams in the last week of class!)

Note: The three **CS** Learning Targets are separate from the 22 main content targets. They are "big picture" items, not assessed via checkpoints but rather through a portfolio as part of the final exam.

How everything else is graded

Daily Prep and Class Activities are graded with either a "check" or an "x", based on completeness and effort. **A "check" is given if the work is turned in on time, and if every item has a response that represents a good-faith effort to be right**. Actual correctness is not factored in, so you should feel free to make honest mistakes and present your best understanding of the concepts, even if it's flawed, as long as you do a thorough job of it. An "x" will be given to work that is late, incomplete (there's at least one item that has no response), or shows insufficient effort (for example just putting down "I don't know" without trying).

AEPs: These are more involved, and are graded using one of four labels: **E** (Excellent/Exemplary), **M** (Meets Expectations), **R** (Revision Needed), or **N** (Not Enough Information/Not Assessable). Those labels are assigned using this flowchart:



EMRN rubric based on the EMRF rubric, due to Rodney Stutzman and Kimberly Race: http://eric.ed.gov/?id=EJ717675

Weekly practice is also graded using the EMRN rubric, except "E" grades aren't awarded. If your work demonstrates thorough understanding of the concepts and meets the expectations of the assignment, then you earn an M and that's the end of it. Otherwise (R or N) you will have the opportunity to revise and resubmit your work (more on that below).

Engagement credits vary in their grading. Many credits are given for simply completing a task (e.g. filling out a survey). Others require that certain standards are met before the credit is given. The criteria for earning the credit will be made clear on the item.

How to revise and resubmit your work

The most significant and challenging work you do in the course — Learning Target checks and AEPs — **can be revised and resubmitted to allow you to improve on previous attempts and raise your grade**. You'll also have limited opportunities to revise and resubmit Weekly Practice. Your course grade is therefore based on what you *eventually* show that you can do, not just the results of a single moment. The process of revision/resubmission depends on the item:

Learning Target check attempts can be revised by reattempting the item on a later Checkpoint or through one of the other means described earlier. For example, if you attempt a Checkpoint problem on a target and

don't do good-enough work, you can reattempt it on a later Checkpoint, or through an oral exam, or a video, or an AEP. Remember, though, only one check per week can be earned through oral exams, videos, or AEPs; and Mastery level on a target requires at least one check earned by a Checkpoint or oral exam.

AEPs earning M, R, or N can be revised and resubmitted at any time just by revising the work based on my feedback and then uploading the revision. They will be regraded using the same standards as originally used. There are two important limitations on your revision and resubmission of AEP's:

> **Two-items-per-week rule: No more than two submissions of AEP sets may be made per week. This can be two new sets, two revisions, or one of each.** A third submission can be purchased with a token (below) but **four or more submissions in a week are not allowed under any cirumstance.**

> **Revision of N grades rule: Students have to spend a token (below) in order to revise any AEP that was graded at "N" (Not Assessable).**

Weekly Practice that earns an R or N can be revised and resubmitted once at no cost. Simply take the feedback you'll get, make corrections, and submit the revision for regrading. However, as with AEPs there are some important limitations on revisions:

> **One-revision-per-week rule: No more than one Weekly Practice revision may be submitted in a given week.**

> **Revision of N grades rule: Students have to spend a token (below) in order to revise any Weekly Practice that was graded at "N" (Not Assessable).**

> **One Free Revision rule: The first revision of a Weekly Practice incurs no cost, but all subsequent revisions cost one token each (below).** This is in addition to tokens spent to revise grades of N.

Daily Prep, Class Activities, and most Engagement Credit opportunities cannot be revised because they are graded on completeness and effort, and therefore can only be done once.

Tokens

Tokens are a fake currency that are used to "purchase" exceptions to course policies and other advantageous items in the course. Every student starts with five of these. One token can be spent for any of the following at any time:

- Attempt a second Learning Target in a given week through non-Checkpoint means
- Submit a third AEP (either revision or new submission) in a given week
- Revise an AEP or Weekly Practice graded "N"
- Extend the deadline on a Checkpoint by 12 hours (request must be submitted prior to the original deadline)
- Extend the deadline on a Weekly Practice set by 24 hours (request must be submitted prior to the original deadline)
- Submit a second revision of a Weekly Practice set
- Purchase 3 engagement credits

With the exception of the last item, tokens may not be "stacked", for example by spending 3 tokens to get a 72-hour Weekly Practice deadline extension. You can stack tokens to purchase engagement credits (e.g. spend 3 to get 9 credits).

How your semester grade is determined

Your grade for the semester is not based on points because most items in the course don't carry point values. Instead, your grade will be based on **the quantity and quality of evidence you can provide of across-the-board mastery of Calculus** — the basic skills found in the Learning Targets, the applications found in AEPs, and your daily work and engagement.

Determining your base grade

To determine your course **base grade** (the letter A/B/C/D/F without plus/minus modifications), use the following table. To earn a grade, you must complete **all** the requirements in the column for that grade; your base grade is the **highest grade level for which all the requirements have been met or exceeded**.

Category:	D	C	B	A
Core LTs (10)	Proficient 5	Master 5, Proficient 5	Master 7, Proficient 3	Master 10
Supplemental LTs (12)	Proficient 6	Master 4, Proficient 4	Master 4, Proficient 6	Master 6, Proficient 4
AEPs (8)	2 M+	5 M+	2 E, 4 M+	4 E, 2 M+
Weekly Practice (10)	3 M	5 M	7 M	9 M
DP + CA (48)	24	34	39	44
EC	30	60	70	80

Again, ***all* of the requirements in a grade column must be met or exceeded in order to earn that grade**. Otherwise your grade is the *highest* grade for which *all* the requirements are met are exceeded. For example, if you only earn 65 engagement credits during the semester, you are not eligible for a grade of B or A in the course; your base grade would be a C at most. **A grade of F is given if not all the requirements for a D are met**.

In this table, please note:

- For AEPs, "M+" means "M or better" which means "M or E". Therefore, for example, if you earn 3 E grades and 3 M grades on AEPs, you've satisfied the requirements for a B because you have earned 2 E's and 4 grades that are "M or better".

- The fifth row of the table is the *sum* of your Daily Prep and Class Activities. There are 24 of each of these planned for a total of 48. If you fall behind in Daily Prep, you can double down on Class Activities to make up for it, or vice versa. But you should plan on completing all or almost all of each of these, as they are only graded on the basis of completeness and effort.

Determining plus/minus modifiers

A "plus" is added to the base grade if all requirements for a base grade are satisfied, *and either* the LT (both the Core and Supplemental) **or** AEP requirement for the next level up is also satisfied; **and** the big-picture portion of the final exam is passed.

A "minus" is added to the base grade above if: (1) All requirements for a base grade are satisfied *except one*, and that one is no more than two levels below the others; **or** (2) You meet the minimum requirements for a base grade but do not pass the big-picture portion of the final exam. In the first case, if the deficient area is more than two levels below, the penalty will be either a minus or a full letter grade, at my discretion.

Academic integrity

The university's academic integrity policy is described in the GVSU Student Code which you can read online here. Additionally, the School of Computing and Information Systems has its own guidelines for academic integrity here: http://www.cis.gvsu.edu/academic-honesty/. **Every student has the responsibility of reading and understanding these policies, especially the consequences for engaging in academically dishonest activities.**

Some of the work you will do in the course involves collaboration; at other times collaboration may be allowed but not required; while at others it may not be allowed. Here are the rules for collaboration on each kind of work you do:

- *Daily Prep and Class Activities*: You may collaborate with others, but your writeup must be in your own words. You may not copy someone's work and submit it as your own, nor may you copy the ideas from someone and simply change the wording.
- *Checkpoints* and other work done on Learning Targets: No interactions at all with another person or with unauthorized sources on the internet is allowed. Any evidence of using information from another person or source will be investigated as academic dishonesty.
- *AEPs*: Similarly, no interactions at all with another person or with unauthorized sources on the internet is allowed.
- *Weekly Practice*: You may discuss main ideas with other students, but you must come to the answer through your own work.

In particular, use of "study" sites such as Chegg or Coursehero, or Q&A sites like Stack Exchange or Quora, to obtain help on graded work other than Daily Prep or Followups is forbidden and will automatically constitute academic dishonesty.

All suspected instances of academic dishonesty will be thoroughly investigated, and whether a student has

committed academic dishonesty is my determination to make based on the evidence. If I determine academic dishonesty has been committed, a report will be filed with the Dean of Students office, and the minimum penalty will be:

- Daily Prep and Class Activities: A grade of "x".
- Checkpoints and other Learning Target work: A grade of "x" and required expense of two tokens to reattempt; for severe cases, you may be barred from reattempting.
- AEPs and Weekly Practice: A grade of "N", and you will not be allowed to revise or resubmit the item for the rest of the semester.

Note these are *minimum* penalties; additional penalties may be given including reduction of course grades and potential suspension from the university.

Please note: There is no need to commit academic dishonesty in this class since you can revise and resubmit almost anything. If you come to believe that cheating or plagiarism is necessary given your situation: DON'T DO IT. Get some help instead and take comfort in the fact that you can just submit your best effort, get feedback, and try again later.

Other course policies

Attendance, deadlines, and late work

Attendance: You are expected to participate in your group's F2F meetings twice per week. If you are feeling well and are comfortable being present in person, you should attend physically. However, if you are not feeling well or are not comfortable being present, **you may exercise one of the online options discussed earlier**. Please note, though, **this does not mean you can skip the meeting entirely**. You are still expected to participate (possibly remotely) with your group when it's your group's day to meet.

Attending the other group's meetings: Please **do *not* attend the F2F meetings for the group you are not part of**. That is, Red Team students should not attend Blue Team F2F meetings and vice versa. "Crashing" another group's meeting will violate social distancing requirements, and students attempting to do so will be asked to leave immediately.

Deadlines and late work: Deadlines are generally strictly enforced, and late work will not be accepted. However, you can spend tokens to extend deadlines for Checkpoints and Weekly Practice sets. Daily Prep and Class Activities deadlines will not be extended.

AEP deadlines: AEP sets do not have fixed deadlines, and you do not have to do all of them. The only deadline is a single deadline for all AEPs of **11:59pm Eastern on Friday, December 11** past which no AEP work of any kind may be submitted. Otherwise, simply work on AEPs at a reasonable, steady pace through the semester and turn them in when they are complete and you're ready to get feedback on them. However, remember the **Two-Item-Per-Week Rule** — you will not be able to procrastinate until the end of the term and do several all at once.

Technology Support

If you encounter issues with technology, please use the appropriate source of help:

- *For help with Blackboard*: Email the Blackboard Help Desk at bbadmin@gvsu.edu or call (616) 331-8526. For hours of operation and more information see https://www.gvsu.edu/elearn/help/.
- *For help with the GVSU network, email, or printing*: Email the GVSU IT Help Desk at helpdesk@gvsu.edu; or call (616) 331-2101 or toll free (855) 435-7488. For hours of operation and more information see https://www.gvsu.edu/it/.
- *For specific help with your computer*: Try the GVSU IT Help Desk (see previous bullet) or contact your equipment manufacturer or computer store.
- *For help with course tools such as Desmos and Campuswire*: Ask a question on the `#tech` channel on Campuswire, seek out the help documentation in the tool, or do a targeted Google search.

Please note that **I (Prof. Talbert) am not able to provide student tech support** as I do not have access to your accounts or knowledge of your hardware. I can help with questions about course tools (Desmos, etc.) but please ask those questions on Campuswire so others can see and help too.

Getting help and support

Math Center: GVSU's Math Tutoring Center is online with Blackboard Collaborate this semester. You can access virtual drop-in tutoring through a link in your Blackboard course called Math Tutoring Center or on our website at http://gvsu.edu/tutoring/math/. Then you need to click on the "Online Math Tutoring Center" button, which will require a GVSU login. There will be tutors online, ready to help, Monday through Thursday 10a – 9p, Friday 10a – 2p and Sunday 6p – 9p starting Wednesday, September 2nd. Bring questions about your technology, on methods and concepts, or on specific problems. All Math Center tutoring is free, so stop by early and often. When you enter the Collaborate room, please type your first and last name so you can get you signed in and connected with a tutor.

Special learning needs: If you have special needs because of learning, physical or other disabilities, it is your responsibility to contact Disability Support Resources (DSR) at 616-331-2490 or http://www.gvsu.edu/dsr/ . DSR will help you arrange accommodations. Then, speak with me in person about making those accommodations and ensure that they are consistent with your arrangements with DSR.

Basic needs security: If you have difficulty affording groceries or accessing sufficient food to eat every day, or if you lack a safe and stable place to live, I encourage you to visit Replenish, a food resource for GVSU students. If you are comfortable doing so, please speak with me about your circumstances so that I can advocate for you and to connect you with other campus resources.

Gender identity and expression: If, for purposes of gender identity and expression, your official name (in Banner) does not match your preferred name, your name can be updated in Blackboard. Please contact the registrar's office to submit this request. The registrar's office will contact the Blackboard administrator to make the change and will also contact your professors to inform them that your name in Banner will not match the name in Blackboard.

Miscellaneous

Recordings of online synchronous meetings: We will use technology for live-streaming class meetings, and recordings of these may be made. Our use of such technology is governed by FERPA, the Acceptable Use Policy and GVSU's Student Code of Conduct. A record of all meetings and recordings is kept and stored by GVSU, in accordance with the Acceptable Use Policy and FERPA. I will not share recordings of your class activities outside of course participants, which include your fellow students, advisors, and any guest faculty or community based learning partners that we may engage with. **You may not share recordings outside of this course**. Doing so may result in disciplinary action.

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

Changes to this syllabus: Changes to this syllabus may occur during the semester. In those cases, the changes will be announced in class and online, and if appropriate, students will be given a voice on how the changes will be implemented. It is your responsibility stay abreast of the information passed along in course announcements so that you will be aware of any changes that take place.

Credits: Portions of the language of this syllabus were adapted from the syllabi of Prof. Matt Boelkins and Prof. David Clark, both of GVSU.

Covid-19 Policies

As you are well aware, we will be having class this semester while trying to navigate a global pandemic that seems to change every day. While we can't predict even the near future, the following are general guidelines and plans for how we can work productively together in the course.

Taking care of yourself

Above all else, **take care of your own physical and mental health** during these difficult times. Make sure you are getting sufficient rest, staying connected to friends and family, and giving yourself time and space to do things you enjoy outside of college. This website lists several good tips for maintaining good self-care in our situation.

Before coming to campus, perform a self-evaluation each time and if you feel even the slightest bit of sickness or Covid-19 symptoms, stay home and participate remotely. You should be on campus only if you feel *completely healthy*. Remember that **you can opt out of your group's F2F meeting at any time and participate online synchronously or asynchronously — no questions asked, no permission needed, no penalty incurred**. Also note that *there are no graded assessments done in class* so you will never have to make up work that was turned in during class.

Keeping our class meetings safe

When you are present in a F2F meeting, please observe the following:

Wear a mask at all times. 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.

Please note, students who remove their masks during class, wear the mask incorrectly (for example, with the nose exposed), or refuse to wear a mask will be reminded of this policy once, and then asked to leave if non-compliance continues.

Observe proper social distancing. Your classroom has been specially arranged so that students are 6 feet apart from each other and from the professor at all times. This is sufficient for social distancing and close enough so that 2-3 students can turn to each other and discuss a concept. We will also leverage technology to allow for remote communication, for example using the chat rooms in Campuswire. **Please do not encroach on the space of another person, or share physical objects such as pens, calculators, or paper.**

Practice appropriate personal hygiene. Wash your hands regularly or use hand sanitizer. If you must cough or sneeze, do so facing away from other people and use the inside of your elbow to cover your mouth, even if you have a mask on. You may wish to bring sanitizing wipes to wipe down your desk and seat before and after class.

If plans change

We will begin the semester in "staggered hybrid" mode, but several things could happen during the semester that might alter this setup. The details for how we respond to events of the next 14 weeks depend on the situation, but please rest assured that I (Talbert) have plans in reserve for all likely scenarios including if the university goes fully online or if I cannot be present due to self-quarantine or infection. **Remember to check your email, Blackboard announcements, and Campuswire daily to stay notified of all course information**.

Please note: I (Prof. Talbert) reserve the right to make changes to the course at any time, including changing the modality of the course (e.g. to fully online) if I believe the situation warrants and independently of global actions GVSU does or does not take. I will always strive to do so with an appropriate level of input from you, but decisions about the course are vested in me.

Encouragement: Although these plans can be scary and demoralizing, I want you to know that **GVSU is doing everything in its power to keep people safe from Covid-19**. If we observe reasonable precautions like the ones described above, **there is no reason to be afraid**. If we stay focused, remain flexible, and give our best work then we will learn just as well as in "normal" times, which I am hopeful will return soon.

Appendix: Learning Objectives and Module Schedule

Coursewide Learning Objectives

Upon completion of MTH 225, you will be able to:

- Represent integers using different number bases, and perform integer arithmetic using different bases and modular arithmetic.
- Formulate, manipulate, and determine the truth of logical expressions using symbolic logic.
- Formulate and solve computational problems using sets and functions.
- Formulate and solve complex counting problems using computational thinking and the tools of combinatorics.
- Evaluate numerical and other sequences using recursion, and solve simple recurrence relations.
- Write clear, correct, and convincing arguments to explain the correctness of a solution using combinatorial proof and mathematical induction.
- Explain the reasoning behind solutions to computational problems clearly to an appropriate audience.
- Apply effective problem-solving skills in solving computational problems.
- Apply computer programming and computational thinking to frame and solve mathematical and computational problems.
- Self-assess one's work and apply feedback from others to make improvements in that work.

Learning Targets

Mastery of Learning Targets in groups A, L, SF, C, SR, and P are assessed using Checkpoints and the alternatives to Checkpoints described earlier. Learning Targets in group CS are *not* assessed by Checkpoints but rather by a portfolio as part of the Final Exam.

- **Group A: Represent integers using different number bases, and perform integer arithmetic using different bases and modular arithmetic**.
  - A.1: I can represent an integer in base 2, 8, 10, and 16.
  - A.2 **(Core)**: I can add, subtract, multiply, and divide two integers written in binary.
  - A.3: I can compute `a % b` given integers `a` and `b` and perform arithmetic mod n.
- **Group L: Formulate, manipulate, and determine the truth of logical expressions using symbolic logic.**
  - L.1: I can use propositional variables and logical connectives to represent statements; and interpret symbolic logical statements in plain language.
  - L.2 **(Core)**: I can write the negation, converse, and contrapositive of a conditional statement and use DeMorgan's Laws to simplify symbolic logical expressions.
  - L.3: I can determine whether a quantified statement is true, false, or underdetermined, and state its negation.
  - L.4 **(Core)**: I can write the truth table for a logical statement.
  - L.5: I can determine if a statement is a tautology and whether two statements are logically equivalent.
- **Group SF: Formulate and solve computational problems using sets and functions**.
  - SF.1 **(Core)**: I can represent a set in roster notation and set-builder notation; determine if an object is an element of a set; and determine set relationships (equality, subset).

    - SF.2: I can perform operations on sets (intersection, union, complement, Cartesian product) and determine the cardinality of a set.
    - SF.3 **(Core)**: I can determine whether or not a given relation is a function, determine the domain and codomain of a function, and find the image and preimage of a point using a function.
    - SF.4: I can determine whether a function is injective, surjective, or bijective.
- **Group C: Formulate and solve complex counting problems using computational thinking and the tools of combinatorics**.
    - C.1 **(Core)**: I can use the additive and multiplicative principles and the Principle of Inclusion and Exclusion to formulate and solve counting problems.
    - C.2: I can calculate a binomial coefficient and correctly apply the binomial coefficient to formulate and solve counting problems.
    - C.3 **(Core)**: I can compute combinations and permutations and apply these to formulate and solve counting problems.
    - C.4: I can use the "Stars and Bars" technique to formulate and solve counting problems.
- **Group SR: Evaluate numerical and other sequences using recursion, and solve simple recurrence relations**.
    - SR.1 **(Core)**: I can generate several values in a sequence defined using a closed-form expression or using recursion.
    - SR.2: I can use sigma notation to rewrite a sum and determine the sum of an expression given in sigma notation.
    - SR.3 **(Core)**: I can find closed-form and recursive expressions for arithmetic and geometric sequences and find their sums.
    - SR.4: I can use iteration and characteristic roots to solve a recurrence relation.
- **Group P: Write clear, correct, and convincing arguments to explain the correctness of a solution using combinatorial proof and mathematical induction**.
    - P.1: I can analyze and write a combinatorial proof of a combinatorial identity.
    - P.2 **(Core)**: Given a statement to be proven by (weak) induction, I can state and prove the base case, state the inductive hypothesis, and outline the proof.
- **Group CS: Demonstrate problem solving, communication,and learning skills appropriate for computer science**.
    - CS.1: I can explain the reasoning behind solutions to computational problems clearly to an appropriate audience.
    - CS.2: I can apply computer programming and computational thinking to frame and solve mathematical and computational problems.
    - CS.3: I can self-assess my work and apply feedback from others to make improvements in my work.

Course Module schedule

Please see the Course Calendar for the dates corresponding to these modules.

Module	Focus	Topics	Text
1	Integer	Representation base 2, 8, 10, 16; two's	Professor Talbert's

Module	Focus	Topics	Text
	representation	complement; binary arithmetic	notes
2	Modular arithmetic	The Division Algorithm, the `%` operator, modular arithmetic, applications to cryptography	Professor Talbert's notes
3	Symbolic logic 1	Propositions, conditional statements, logical operations, truth tables	Levin 0.2 and 3.1 for part, plus Professor Talbert's notes
4	Symbolic logic 2	Logical equivalence, predicates, quantification	Levin 0.2 for part plus Professor Talbert's notes
5	Sets	Set notation; subset and element relations; union, intersection, and complement; Venn diagrams; cardinality and power sets; Cartesian products	Levin 0.3
6	Functions	Functions and non-function; injective, surjective, and bijective functions; special functions for CS (floor, ceiling, etc.)	Levin 0.4 + Professor Talbert's notes for special functions
7	Basic advanced counting	Additive and multiplicative principles; binomial coefficients (intro to recurrence relations and recursion)	Levin 1.1, 1.2
8	Combinations and permutations	Combinations and permutations, combinatorial proof	Levin 1.3, 1.4
9	Advanced advanced counting	Principle of Inclusion and Exclusion, stars and bars methods	Levin 1.5, 1.6
10	Sequences and recursion	Closed-formula and recursive definitions of sequences; arithmetic and geometric sequences	Levin 2.1, 2.2
11	Solving recurrence relations	Checking for solutions; the characteristic root method	Levin 2.3, 2.4
12	Mathematical induction	Idea of proof; weak mathematical induction	Levin 2.5