MTH 325: Discrete Structures for Computer Science 2
Grand Valley State University, Winter 2015, Sections 01 and 02
Instructor: Robert Talbert, PhD., Associate Professor of Mathematics

Welcome to MTH 325. Before we get into any details, here are ten things you need to know about the course.

1. **I want you to be successful in the class.** My job is to help you learn and develop a deep understanding of the course material. I am on your side! I would like our relationship to be like that between a client and a consultant who work together to achieve an end goal. Please feel free to come speak with me at any time about the course and your work in it.
2. **I expect you to be actively engaged in your learning**. In order to learn mathematics, you have to *do* mathematics. In MTH 325 you'll be expected to work actively, and contribute to others' work. There is very little lecture during class time; instead we'll be solving puzzles and asking and answering questions.
3. **This is a mathematics course with a computer science flavor.** Although we will use computers and some programming, and talk about computer science concepts, the primary focus is to study the three main ideas of the course -- relations, graphs, and trees -- from a *mathematical* point of view. One of the goals of the course is to develop a sense of how to look at computing concepts from this point of view.
4. **This course uses an "inverted" structure**. We will dedicate the class meeting time to work on the hardest material while we are all together to help each other. In order to make this happen, the basic instruction on course material will be moved to pre-class assignments called *Guided Practice*, in which you will watch video, read from the textbook, and work exercises to prepare yourself for the in-class work.
5. **Preparation for class and fluency with basic concepts before coming to class is essential for success.** If you don't prepare for class, you won't be able to participate in the in-class work and therefore you'll not have the foundation for doing other work in the class. Stay on top of your Guided Practice and take it seriously!
6. **This course uses a points-free, competency-based grading system.** In our system, each student chooses the grade he or she wants to earn in the course and then works through a variety of assignments (called *Learning Modules*) to demonstrate the level of competency that grade requires. There are no points!
7. **You will have opportunities to demonstrate mastery repeatedly on each objective throughout the semester**. You will have the chance to revise many of the items you submit for assessment. In return, you are expected to *master* the concepts in those items and not just get things half-right.
8. **Most work in this class is graded on a pass/no pass basis, so careful attention to the specifications for acceptable work is a must**. Work in the class is marked on the basis of whether it passes a set of quality specifications. It's quite possible to earn Pass grades on every assessment item the first time, but this requires paying attention to your work and giving a strong effort to it.
9. **The grade you earn in the course will be based on how well you <u>eventually</u> demonstrate mastery of course learning objectives**. You'll have repeated opportunities for re-attempts and revision on assignments in case you don't Pass the first time. The idea is to learn from your mistakes and have a safe place in which to make them (in moderation).
10. **You may ask a question about anything at any time, especially in office hours.** The material in this course is not necessarily easy, and at some point you will get stuck or frustrated. This is part of the learning process, so don't panic. Instead, seek out help. If you cannot make my posted office hours, you can always schedule an appointment and I will prioritize my time to meet you. I won't do your work for you, but I will help you ask the right kinds of questions that will help you get unstuck.

Remember: I want you to be <u>active</u>; I want you to <u>ask questions</u> and <u>learn deeply</u>; and I want you to <u>be successful</u>.

How to Be Successful in MTH 325

I want you to be successful in the course and will be working hard to make sure you always have a clear path to success. But I cannot walk that path for you! It will take considerable effort on your part. To do this and be successful, you will need to do the following:

1. **Prepare diligently outside of class and come to class ready to work**.
    a. Get an early start on all Guided Practice assignments. These are usually posted 10 days in advance.
    b. DON'T PROCRASTINATE on Guided Practice by waiting until the night before they are due.
    c. Work diligently on Guided Practice to do all the reading and background work and complete all the exercises with a good-faith effort.
    d. If you get stuck on Guided Practice, ask for help -- email me, work with a friend, whatever.
    e. Review your work on Guided Practice and prepare questions before arriving at class.
2. **Actually come to class**.
3. **When in class, be engaged and active in your learning**. This means:
    a. Use what you learned in Guided Practice to extend yourself to a harder problem.
    b. Make effective use of the class environment to ask questions of your friends and me, and seek help where you need it and give help to others.
    c. Choose to avoid inappropriate distractions in class such as Facebook or texting.
4. **Also be engaged and active in your learning after class.** This means:
    a. Come to office hours, make appointments, or send email when you get stuck on a problem or have a question about something.
    b. Spend 2---3 hours outside of class for every hour you spend in class, so roughly 6--9 hours a week just on MTH 325.
    c. The time you spend on MTH 325 is to spent *purposefully*, with a plan for what you will do and when you will do it as well as a plan for getting help if you get stuck.
5. **Adopt a "growth mindset" for your intellectual development**. According to Carol Dweck, the psychologist who coined this term, those with a "fixed mindset" believe their basic qualities such as intelligence or mathematical skill are fixed quantities. On the other hand those with a "growth mindset" believe that these basic qualities can be improved through dedication and hard work, and when they fail at something, they take it as a learning opportunity and get better by learning from their mistakes. (More at http://edglossary.org/growth-mindset/.)
6. **Practice self-regulated learning.** This means that you are paying attention not only to what you are learning but how you are learning it, and you are not dependent upon the instructor or anyone else to learn things. It means in particular:
    a. Be aware at all times of what you are supposed to be learning.
    b. When you work, work purposefully on activities that show where your learning is in relationship to the learning objectives for the course. Some of these activities are ones that you take on yourself, or you make them up yourself, even if no grade is involved
    c. If you know there's a gap between your abilities and the learning objectives, take initiative to find things that will help you close it.

I want you to be successful! It is very easy in MTH 325 to cooperate with me on this by doing these things.

Course Information and Policies

Meeting times and places: Section 01 meets MWF 12:00-12:50pm in MAK BLL-116. Section 02 meets MWF 10:00-10:50am in MAK A2167.

Instructor: Dr. Robert Tabert, Associate Professor of Mathematics, MAK A-2-168. You can reach me by email at talbertr@gvsu.edu, and this is the best way to reach me. Please note that to respect time with my family, I typically do not answer email between 6pm and 6am unless it is urgent. You can also find me on Twitter at http://twitter.com/RobertTalbert, on Google+ at http://google.com/+RobertTalbert, and on Github at https://github.com/RobertTalbert. My office phone is (616)331-8968.

Office hours: Monday and Wednesday from 2:30--3:30, and Friday from 1:00--3:00; other times by appointment. If these times don't work, you can schedule an appointment with me; if there's no acceptable appointment time, just send me an email. Appointment time slots are typically 15 minutes long. When visiting office hours or appointment times, please plan ahead and bring a list of specific questions you'd like to ask. If your question is about a problem on a Learning Module, please come prepared to discuss the work you have already tried. Also please be advised that I do not proofread work on Learning Modules before they are submitted.

Prerequisite: Successful completion of MTH 225. This course assumes and requires a working knowledge of logic, sets, functions, algorithms, and proof (including proof by induction). If you have a concern about your preparation for the course, please discuss it with me.

Textbook: *Discrete Mathematics and its Applications*, by Kenneth Rosen, Sixth Edition. Note: The most current edition of the Rosen text is the Seventh; we use the Sixth edition because used copies are more readily available. If you own the Seventh edition, you'll need to make some adjustments to the sequencing of topics; please see me about this.

Software: We will be using the classroom response system Learning Catalytics (http://learningcatalytics.com) for various purposes in the course. You will need to purchase a license for this software; a six-month license costs $12. If you already own a license for Learning Catalytics for another class this semester, you do not need to purchase a new one. We will also be using the computer algebra system Sage (http://sagemath.org) and the cloud-based computing platform SageMath Cloud (http://cloud.sagemath.com) in the course; both of these are free.

Hardware: In order to use Learning Catalytics, you will need to possess a portable computing device that can connect to the campus wifi network through a standard web browser, and bring it to class every day. Such devices include laptops, netbooks, Chromebooks, tablets, smartphones, and wifi-enabled music players. If you do not own or cannot borrow such a device, the department has a small fleet of Android tablets that can be loaned out during class meetings; please inform me 24 hours in advance if you will need one. If bringing a portable device to class each day raises problems for you, please speak to me about it.

Announcements and Assignments: All announcements and assignments will be given in class, posted on the course Blackboard site, and/or sent through email. You are responsible for checking your email twice daily and checking for all such announcements, including those given during classes in which you are absent or late. Please make sure to check Blackboard and your GVSU email address regularly.

Important dates: There will be no class on the following days: Friday, January 9 (due to my being gone for a workshop); Monday, January 19 (due to the Martin Luther King, Jr. recess); and during the week of March 2--6

(Spring Break). Also, the last day to drop the class and receive a grade of W is Friday, March 6; note that this is during the week of Spring Break.

Attendance/Makeup policy: If you miss a class that is a designated timed assessment period, you may not receive a free makeup unless you can document within 24 hours that your absence was due to a severe illness or emergency. If you miss a timed assessment period for any other reason, you must spend one token to receive a makeup, and this makeup must be done on a schedule of my choosing. The same policy is in place for absences from a class period during which a Concept Check is given. Makeups for the final exam session are not allowed except in instances of documentable emergencies and severe illnesses; i.e. you cannot spend tokens to make this session up. Please contact me before class if you are going to miss a timed assessment period. Finally, I reserve the right to allow or disallow any makeup request based on the circumstances.

Collaboration and Academic Honesty: The policy for MTH 325 is as follows:

- You **may** collaborate with other students on Guided Practice assignments and any practice problems given in class. You may collaborate and use technology as much as you wish, and no disclosure of your collaboration is necessary.
- You **may not** collaborate with other students on timed assessments (Concept Checks and CORE-M problems done during timed assessment periods).
- For work on Learning Modules: you **may not** collaborate with any other student or seek help from any source other than your instructor and your textbook (including but not limited to tutors, other students, other textbooks, and internet resources such as Yahoo! Answers and Stack Exchange). **You may not discuss these problems in any way, shape, or form with anyone other than your instructor**.
- Enabling another student to violate these rules, or providing help to another student in violation of these rules, is a violation of the rules.
- For any assignments not listed here, assume that no collaboration is allowed. (Additional guidelines for academic honesty on the Application Project will be provided later.)
- **The minimum penalty for plagiarism or inappropriate collaboration is a No Pass grade on the affected assignment and an elimination of any further chances to revise the work. In especially egregious cases, the penalty can be significantly more severe, up to and including automatic failure of the course and possible suspension from GVSU. In addition, all violations of academic integrity will be reported to the Dean of Students and the Dean of the College of Liberal Arts and Sciences**.

Special Needs: If you have special needs because of a physical, learning, or other type of disability, please feel free to discuss this with me. Furthermore, if you have a disability and think that you may need help evacuating our classroom or building in an emergency situation, please let me know tso that I can develop a plan to assist you. For additional resources, please contact Disability Support Resources at (616)331-2490 or online at www.gvsu.edu/dsr.

Assessment and Grading

This course uses a **points-free, competency-based assessment system** that differs from traditional points-based systems in some very important ways. Under this system, the grade you earn in the course and the workload that you take on are a result of your choices, your effort, and the quality of your work rather than the outcome of a statistical calculation. It is designed to provide you with control over the grading process, transparency as to your progress toward a course grade, and a final course grade that truly reflects your actual mastery of course concepts. What follows here is an abbreviated outline of the grading system used in this class. For full details, please see the document **MTH 325 Assessment and Grading Policy** which is given separately and found online here.

Learning Objectives: The entire course is organized around a list of Learning Objectives that specify individual tasks that demonstrate mastery of various items in the course. These objectives fall into three categories:

- **Concept Check (CC)** objectives that address foundational understanding of terminology and mathematical results, basic computation and application, and problem solving;
- **Module (M)** objectives that address higher-level tasks such as analysis, application, and creative work through programming or proof writing; and
- **Core Module (CORE-M)** objectives, which are a subset of the list of M objectives that are especially important for the course.

There are 35 CC objectives, and 33 M objectives, -- and 20 CORE-M objectives within the list of M objectives -- in the course, a full list of which is provided separately.

Ways of assessment: Your mastery of the learning objectives is measured through different means:

- Mastery of the CC objectives will be assessed through **Concept Checks**, which are quizzes given roughly once a week in class.
- Your mastery of the M objectives will be assessed through **Learning Modules**, which are bundles of problems that are grouped around a particular theme and done individually outside of class. Each learning module comes in two levels; Level 1 learning modules focus on foundational tasks while Level 2 modules focus on more advanced work. There are also two additional modules required of all students: *Getting Started* and *Tech Competency* which will establish baseline knowledge of the course and of the technological tools used in it.
- Finally, your mastery of the CORE-M objectives will be assessed through problems (one problem for each CORE-M objective) done during **timed assessment periods** in class. There are four timed assessment periods planned for the class.

Method of marking: Generally speaking, each assessment item is marked on a two-level scale: either **Pass** or **No Pass**, on the basis of whether or not the work satisfies a list of specifications for acceptable work.

- On *Concept Checks*, each CC objective is assessed by a single item to be completed. These usually are objective items such as stating definitions, multiple-choice, true/false, fill-in-the-blank, or simple calculations where only the answer is checked. You will **Pass** a CC objective if you answer correctly, and receive **No Pass** otherwise.
- On *Learning Modules* (untimed), the entire module is marked either **Pass** or **No Pass** using a detailed list of specifications, given separately.
- On *CORE-M objectives assessed during a timed assessment period*, each individual objective is given a separate problem to work that assesses it. Your work is marked **Pass** or **No Pass** using a simplified list of specifications based on the larger list of specifications for Modules. (For example, the rules for grammar and handwritten work will be suspended for timed work.)

Timed assessment periods: At four different times during the semester, we will set aside the entire class period for you to attempt problems aimed at the 20 CORE-M objectives. Before each timed assessment period, you will be surveyed as to which CORE-M objectives you would like to be assessed on during that period. You may attempt as many or as few as you like. For all the ones you select, you will receive a problem that assesses that CORE-M objective. If your work on a timed problem is **Passing**, then you have demonstrated mastery on that learning objective, and you will not be tested on it again. If your work does **Not Pass**, then you can elect to try a new instance of that problem at a later timed assessment period. You may also elect to be re-assessed on CC objectives during timed assessment periods if you have not passed some of those; as with CORE-M objectives, you will need to specify which CC objectives you want to be assessed on in advance.

Other work in the course: There are two other forms of work in the class, *Guided Practice* and the *Application Project.*

- Guided Practice assignments are structured pre-class preparation activities. These will be posted to the course Blackboard site and worked online, with your work submitted through a Google Form. Guided Practice is graded **Pass** and **No Pass** on the basis of completeness and effort only; correctness of answers is not factored into the grade. A **Pass** mark means that you have submitted work that is complete and shows a good-faith effort to give a legitimate answer to each item. A No Pass is given to a submission that is late, or not all items show significant good-faith effort. For example, putting "I don't know" or "I'm lost" as one of the answers will result in **No Pass**.
- The Application Project is a large-scale project in which students will work in teams to solve a problem or provide a service that involves relations, graphs, and/or trees. Much more information on the Application Project will come your way around week 3.

The table below shows the requirements necessary for each letter grade. To earn the grade listed in each row, a student must satisfy ALL the criteria in that row.

To earn:	Pass this many CC objectives:	Pass this many CORE-M objectives:	Pass these Learning Modules:	Sustain this level of class preparation:	Application Project:
A	32/35	18/20	Getting Started Tech Competency 9/9 Level 1 5/9 Level 2	Pass at least 75% of Guided Practice	Complete with passing mark
B	30/35	16/20	Getting Started Tech Competency 7/9 Level 1 3/9 Level 2	Pass at least 75% of Guided Practice	Complete with passing mark
C	26/35	14/20	Getting Started Tech Competency 6/9 Level 1	Pass at least 75% of Guided Practice	n/a*
D	22/35	12/20	Getting Started Tech Competency 4/9 Level 1	Pass at least 50% of Guided Practice	n/a*

* The application project is only required of students opting to earn a grade of A or B.

A grade of F is given if <u>any one</u> of the requirements for a D is not met. That is, if a student earns an F in the class, at least one of the following happened: Fewer than 22 out of 35 CC objectives were passed; ***or*** fewer than 12 out of 20 CORE-M objectives were passed; ***or*** fewer than 4 of the Level 1 modules were passed; ***or*** either the Getting Started or Tech Competency modules were not passed.

Earning plus/minus grades:

- To earn a "plus" grade for a letter: Pass the required number of CC and CORE-M objectives for the next letter up. (Example: To earn a C+, fulfill all the requirements for a C, <u>and</u> pass 30/35 CC objectives <u>and</u> pass 16/20 CORE-M objectives.)
- To earn a "minus" grade for the next letter up: Pass the required number of CC and CORE-M objectives for the next letter up *and* one additional Level 2 module beyond the requirement for the base letter grade. (Example: To earn a B-, fulfill all the requirements for a C, <u>and</u> pass 30/35 CC objectives <u>and</u> pass 16/20 CORE-M objectives <u>and</u> pass *one* Level 2 module.)

Partial credit: Note that **partial credit is not awarded on any assessed item**. Rather, your work is given a mark based on whether, in my best professional judgement, it meets the appropriate specifications for acceptable work.

Tokens: Each student will be given five "tokens" at the beginning of the semester. Each token can be cashed in for one of the following:

- A do-over on a Learning Module that received a No Pass mark.
- A 24-hour extension on a deadline.
- A makeup timed assessment period, provided the makeup is done on my schedule, if you miss a timed assessment period due to an unexcused absence. *This does not apply to the final exam session (below)*.
- A makeup for a Concept Check, provided the makeup is done on my schedule, if you miss a Concept Check due to an unexcused absence.

Opportunities to earn additional tokens may be given during the semester. (For example, you will have such an opportunity on the Getting Started module.) Suggestions for other uses of tokens are always welcome.

Final exam: There is no final exam for this course. Instead, the entire 110-minute final exam period will be used for you to re-attempt any CC objective or CORE-M objective that you have not passed yet. Each CC or CORE-M objective that has not been passed may be re-attempted during the final exam period only once, but you may re-attempt as many of these objectives as you need. If you are satisfied with your situation regarding CC and CORE-M objectives prior to the final, you are not required to attend the exam session; but be advised that completing more CC and CORE-M objectives can boost your grade to a "plus".

Appealing marks on your work: If you believe that your work has truly met the specifications for acceptable work but it did not receive a Pass mark, I encourage you to schedule an appointment with me to discuss it. I will ask you to make a case for why your work satisfies the specifications, and I will carefully and respectfully consider your case. No tokens need to be spent for this. However, make sure that you have a legitimate case to make and are not frivlously asking for credit.

Semester Calendar -- subject to change

Week	Topics	Monday	Wednesday	Friday
1	**Startup and technology**	Jan 5 Startup	7 Technology training	9 NO CLASS
2	**Properties and representation of relations**	12 Start 8.1 GP 8.1 due	14 End 8.1/Start 8.3 GP 8.3 due	16 End 8.3
3	**Closures of relations**	19 MLK recess - NO CLASS	21 CC 8.1,8.3 Start 8.4/GP 8.4 due	23 End 8.4
4	**Equivalence relations**	26 CC 8.4 Start 8.5/GP 8.5 due	28 End 8.5	30` Timed assessment period
5	**Partial orderings and graphs**	Feb 2 CC 8.5 Start 8.6/GP 8.6 due	4 End 8.6	6 Start 9.1 GP 9.1 due
6	**Graph terminology and representations**	9 CC 8.6, 9.1 Start 9.2/GP 9.2 due	11 End 9.2	13 Start 9.3 GP 9.3 due
7	**Graph isomorphism and connectivity**	16 CC 9.2 End 9.3	18 Start 9.4 GP 9.4 due	20 Timed assessment period
8	**Euler and Hamilton paths**	23 CC 9.3, 9.4 Start 9.5/GP 9.5 due	25 End 9.5	27 CC 9.5 + leftovers and timed assessment period
March 2--6: Spring Break (Last day to drop with W = March 6)				
9	**Shortest-path problems**	Mar 9 Start 9.6/GP 9.6 due	11 Start 9.7/GP 9.7 due	13 **TBA!**
10	**Graph coloring**	16 CC 9.6, 9.7 Start 9.8/GP 9.8 due	18 End 9.8	20 Timed assessment period
11	**Trees and applications**	23 CC 9.8 + leftovers Start 10.1/GP 10.1 due	25 End 10.1	27 Start 10.2/GP 10.2 due
12	**Tree traversal and spanning trees**	30 CC 10.1 End 10.2	Apr 1 Start/end 10.3 GP 10.3 due	3 Start/end 10.4 GP 10.4 due
13	**Minimum spanning trees**	6 CC 10.2, 10.3, 10,4 Start 10.5/GP 10.5 due	8 End 10.5	10 CC 10.5 Rest of period free/TBA
14	**Application project**	13 Timed assessment period	15 Project presentations	17 Course debrief