Warning: This course is intense, even during a traditional 15-week semester. The summer course covers the same topics with the same amount of homework and exams, so it will be triply intense during this 5-week summer session. You should not plan to work full-time while taking this course, and you should not plan to go on vacation while the course is in session.

Some other things to consider as you decide whether to register for this class:
- There are specific technical requirements for this course. See the section on Computer Software below.
- You are required to take the exams for this course in a proctored environment. See the section on Exams below.

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          class materials at http://canvas.jcu.edu/
Course dates: June 15 – July 16

Office hours*:

Monday	Tuesday	Wednesday	Thursday
10:20 – 12:00	10:20 – 12:00	10:20 – 12:00	10:20 – 12:00
1:30 – 3:30	1:30 – 3:30	1:30 – 3:30	1:30 – 3:30

*These are times when I will generally be in or near my office and responding to phone and e-mail, except when I am proctoring exams for this course. If there are students physically present in my office, or if I have stepped out for a few minutes, I will not answer the telephone – but if you leave a message and a callback number, I will return your call as soon as possible. Similarly, I will respond to e-mail promptly. In the evenings and on Friday-Sunday, I will generally check e-mail frequently and respond as quickly as I can. If you live reasonably near campus, your interactions with me will be most beneficial if you come to my office so that we can have a face-to-face interaction. Past experience has shown, though, that telephone conversations are reasonably effective.

Content and purpose: This course is an introduction to mathematical logic and proof, in the setting of discrete mathematics. As such, it is a required course for B.S. and B.A. degrees in Mathematics, as well as for the Minor in Mathematics, and it is a prerequisite for most upper level math courses. In this class, you will learn to read and write mathematical proofs of results about sets, functions, relations, and fundamental properties of the integers. You will learn to

write direct proofs as well as proofs by induction, contrapositive, and contradiction. You will also learn some basic information about counting techniques, graphs, and matrix operations.

Goals and Objectives:

- Students will state and use precise mathematical definitions, give examples of structures that satisfy each definition, determine whether a given structure satisfies a definition, and construct counterexamples.
- Students will use algorithmic processes such as the Euclidean Algorithm and elementary row operations to solve computational problems.
- Students will construct mathematically correct and complete proofs, using a variety of techniques. In these proofs, they will use definitions and previously proved results appropriately, and will use correct logic.
- Students will evaluate the validity and completeness of a mathematical argument.
- Students will communicate clearly in the language of mathematics.

Text: There is no required textbook for this course. If you want a written reference, most sophomore level discrete math or "introduction to higher mathematics" texts should be appropriate.

Computer Software: You must have access to the internet with the ability to play MP4 video files. (Most browsers and mobile devices support this file type.) You must also have Microsoft Word and MathType (available for PC or Mac). It's possible to use MathType with a word processing program other than Microsoft Word, but you will most likely find it very cumbersome. You should purchase MathType directly from Design Science, at http://www.dessci.com/en/. The academic price is roughly $57. Be sure to get the correct version for your computer (Windows or Macintosh). You should install and test this software before the first day of class. Approximately one week before the beginning of the course, I will post an instructional video and a sample assignment so that you can practice with MathType and make sure it works on your computer before you must use it for homework.

Instructional Method: Instruction in this course will be in the form of screen recordings (videos). JCU summer classes traditionally meet on Monday-Thursday, and I have organized the course along those line. Each Friday I will post the videos for the coming week, indicating which videos correspond to which day of that week. Total playing time for each day will vary, but will not exceed 1.5 hours. Because I expect you to pause the videos to work examples or catch up on writing notes, this corresponds on average to roughly 2.5 fifty-minute class periods in a face-to-face class. In addition to e-mail and the telephone, students can use the Discussion feature in Canvas to interact with each other and me throughout the course.

Exams: You will take three midterm exams and a comprehensive final exam. ***You must take the exams in a proctored environment***, and you must bring an official form of identification with you to each exam. Calculators are not permitted during exams.

- If you reside within a reasonable distance of JCU (roughly 40 miles), you must take your exams at JCU, where they will be proctored by me at no additional charge.
- If you reside further away, you must make arrangements for a proctored exam at an approved higher education institution. (A public library is not an approved exam location.) Many community colleges and branches of large universities provide this service; you are responsible for any fees associated with taking exams.

Regardless of where you plan to take your exams, you must submit a **proctor approval form** to me at least four days in advance of each exam. This form will be available with the other course materials at least one week before the beginning of the course. I will make reasonable accommodations if you must miss an exam in case of emergency, provided that you have submitted the required proctor approval form. If you do not submit the proctor approval form at least four days in advance of an exam, and you must miss the exam for any reason, you will not be permitted to make it up.

Quizzes: There are brief quizzes embedded in some of the instructional videos. Some of these quizzes are anonymous; others will be graded.

Homework: You will receive a homework assignment to go along with each section of class notes. ***There will be homework due every day of class, except on the first and last days.*** Most students find that the homework in this course takes about two hours for every 50-minute class period. So you should plan on 4-6 hours of homework each class day, in addition to the 2+ hours of watching videos. I will grade your work for clarity and mathematical correctness, holding you to high standards of mathematical exposition. I will do my best to always return homework within 24 hours of the due date. You will receive more information on submission procedures in a separate document on the first day of class. Homework problems fall into two categories:

- *Peer Reviewed* homework consists of theoretical questions which are usually proofs or counterexamples. Students will take turns submitting solutions and reviews of these solutions. The solutions and reviews will be posted on Blackboard, along with my comments. I expect every student to attempt to solve every problem, regardless of whether s/he is the official solver for that problem. After reading the posted solutions and comments for a problem, every student will do an analysis of the errors, if any, in that problem. You will always have at least 24 hours to complete an initial solution or a review, and you will always type these using MS Word and MathType. Because other students depend on your solutions and reviews in order to do their work, late penalties for peer reviewed homework are severe. Because of the peer review process, different people will have different due dates for the same problem. Use the calendar feature of your phone or Google or Canvas to keep track of your personal due dates.
- *Written* homework consists of problems that everyone does and submits. I encourage you to converse with your classmates in devising strategies for solving these problems, but I expect that you will write your solutions independently of any other person. In most cases, you will type your solutions using MS Word and MathType, but there are a few

instances when I will ask you to scan or photograph your written work instead. You will frequently have multiple assignments due on the same class day.

Writing standards: In the section describing liberal education at John Carroll University, the Undergraduate Bulletin states: "Fluency in written expression is essential to a liberal education. The University expects students at all times to maintain acceptable standards of written English. Failure to maintain these standards in any class work may result in the lowering of the final course grade." The work that you submit in this course serves to demonstrate both your mastery of concepts and your ability to communicate those concepts in the language of mathematics. For this reason, I will grade your work for mathematical correctness as well as for clarity of presentation.

Late Policies: You may turn in up to three late written homework assignments, provided you discuss the situation with me in advance of the due date and time. Multiple late assignments that are due on the same day count as separate late assignments. There is a 40% penalty for peer reviewed homework that is up to one hour late, and a 60% penalty for peer reviewed homework that is between one and two hours late. Peer reviewed homework that is submitted more than two hours late will receive not credit. Due dates and times are all in Eastern Daylight Time. If you are taking this course while in a different time zone, you'll need to adjust your due dates accordingly.

Grading: Point values for written homework problems vary. Initial solutions of peer reviewed problems are worth 10 points, reviews and subsequent solutions are worth 5 points, and analysis of each peer reviewed problem is worth 2 points. The midterm exams will be worth 150 points each, and the final exam will be worth 200 points.

Points in different categories carry different weights. Your course grade will be based on the following.

Peer Reviewed Homework	Written Homework and Quizzes	Midterm Exams	Final Exam
10%	15%	54%	21%

The scale for determining course grades is 90-100 (A–/A), 80-89 (B–/B/B+), 70-79 (C–/C/C+), 60-69 (D/D+), with plus and minus grades being assigned at my discretion in borderline cases. There are a few exceptions:
- I will reduce by one letter the grade of any student who does not submit at least 80% of the assigned peer reviewed homework and at least 80% of the assigned written homework.
- I reserve the right to assign a grade of *F* to any student who does not pass the final exam.

Getting help: Your best bet for getting help when you have questions about material in this class is to contact me. I encourage you to come see me in person when possible.

Academic honesty: The work you turn in to me must be your own. I encourage you to work with others on homework, but you should write up solutions to problems yourself, without copying from another person's work. If you turn in work that has clearly been copied from or written by another person, I will assign a score of 0 for that assignment. Repeated instances of copying homework problems may result in a score of 0 for all future assignments in the course. Cheating in any form on an exam or quiz (e.g., copying from another student, accessing unauthorized books, notes, or electronic devices, or engaging in any other behavior which is intended to misrepresent your knowledge of the exam material) will cause you to earn a score of 0 on that exam. A second instance of cheating on an exam or quiz will result in your receiving a grade of *F* in the course. In accordance with University policy, I will send a written report of any incident of cheating on an exam or quiz to the dean of the College of Arts and Sciences. She will provide you with a copy of my report, and will keep a written record of the complaint in your file. The dean will review the case and determine if, in light of other information and records, further disciplinary action is warranted. See the Undergraduate Bulletin for procedures for appealing charges of academic dishonesty.

Treating others with respect: John Carroll University is committed to fostering ethical and moral values that are consistent with Jesuit and Catholic traditions. Among the central values of the University are the inherent dignities of every individual as well as the right of each person to hold and to express his or her viewpoint. When these views conflict it is the obligation of members of the community to respect other perspectives. The University welcomes students, faculty, staff, and visitors from diverse backgrounds and it works to ensure that they will find the University environment free of discriminatory conduct. It is unacceptable and a violation of University policy to harass, abuse, or discriminate against any person because of age, race, gender, ethnicity, sexual orientation, religion, or disability.

Furthermore, each member of the JCU community is expected to take an active role in fostering an appreciation for diversity and inclusion and sending the message that bias-related acts will not be tolerated. "Bias" is defined as intentional or unintentional actions targeting a person because of a real or perceived aspect of that person's identity, including (though not limited to) age, gender, religion, race, ethnicity, nationality, sexual orientation, gender identity, or (dis)ability. All bias incidents, including those occurring in the classroom, should be reported using the JCU Bias Reporting System at http://sites.jcu.edu/bias/. Questions about the Bias Reporting System or bias incidents may be directed to Dr. Terry Mills, Assistant Provost for Diversity and Inclusion, at tmills@jcu.edu or (216) 397-4455. For more information about University policies and community standards for appropriate conduct, please refer to the Dean of Students web page at http://sites.jcu.edu/deanofstudents. For more information about the University commitment to diversity and inclusion, please see http://sites.jcu.edu/diversity.

Students with disabilities: In accordance with federal law, if you have a documented disability (Learning, Psychological, Sensory, Physical, or Medical) you may be eligible to request accommodations from the Office of Services for Students with Disabilities (SSD). Please contact the Director, Allison West at (216) 397-4967 or go to the office located in room 7A, in the Garden Level of the Administration Building. After your eligibility for accommodations is determined, you will be given a letter which, when presented to me, will help me know best how

to assist you. Please keep in mind that accommodations are not retroactive so it is best to register before the beginning of the course. Only accommodations approved by SSD will be recognized in the course. Please contact SSD if you have further questions.

Important Dates: I will require that students who take their exams at JCU do so at the same time. The default time is 10:20 a.m. – 12:20 p.m., but I'm willing to adjust that, within reason, to accommodate your schedules. I have a class that meets from 8:00 a.m. – 10:10 a.m., so earlier exam times are not an option.

        June 23 ....Exam 1
        July 1..........................Exam 2
        July 13........................Exam 3
        July 16........................Final Exam

Schedule of Topics:

Week 1	Divisibility, Logic, Division Algorithm, Euclidean Algorithm, Fundamental Theorem of Arithmetic
Week 2	Sets, Induction, Pigeonhole Principle, Counting Techniques, Relations
Week 3	Equivalence Relations, Partitions, Modular Arithmetic, Functions
Week 4	Inverse Functions, Graphs, Matrix Algebra
Week 5	Matrix Algebra, Course Review