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| Dr. John Estes Fitzhugh 308 [jestes@belhaven.edu](mailto:jestes@belhaven.edu) 601-968-5993  **Office Hours:** M: 10-11, 2-3 T: 1-3 W: 10-11, 2-4 Th: 1-4 F: 1-3 **Textbooks:**  Proofs Long-Form, Jay Cummings Purchase in the book store or Amazon  https://www.amazon.com/Proofs-Long-Form-Mathematics-Textbook-Math/dp/B08T8JCVF1/    Book of Proof, 3rd Ed, Richard Hammack ISBN: 978-0-9894721-2-8  http://www.people.vcu.edu/~rhammack/BookOfProof/ | [asy] defaultpen(linewidth(0.7)); unitsize(15); int n = 6; pair shiftR = ((n+2),0); real r = 0.3; pen colors(int i){ return rgb(0.4+i/(2n),i/n,1-i/n); } /* shading */ void htick(pair A, pair B,pair ticklength = (0.15,0)){  draw(A--B);  draw(A-ticklength--A+ticklength);  draw(B-ticklength--B+ticklength); }   /* triangle */ draw((0.5,0)--(n-0.5,-n+1),linetype("4 4")); for(int i = 0; i < n; ++i)  draw((0,-i)--(i,-i)); for(int i = 0; i < n; ++i)  for(int j = 0; j <= i; ++j)   filldraw(CR((j,-i),r),colors(i));    /* arc arrow */ draw( arc((n,-n+1)/2, (1.5,-1.5), (n-1.5,-1.5), CW) ); fill((n-1.5,-1.5) -- (n-1.5,-1.5)+r*expi(5.2*pi/6) -- (n-1.5,-1.5)+r*expi(3.3*pi/6) -- cycle); /* manual arrowhead? avoid resizing */   /* square */ draw(shiftR+(0.5,0)--shiftR+(n-0.5,-n+1),linetype("4 4")); for(int i = 0; i < n; ++i)  draw(shiftR+(0,-i)--shiftR+(i,-i)^^shiftR+(n,-n+1)-(0,-i)--shiftR+(n,-n+1)-(i,-i)); for(int i = 0; i < n; ++i)  for(int j = 0; j < n+1; ++j)   filldraw(CR((j,-i)+shiftR,r),colors((j <= i) ? i : n-1-i));   /* labeling and ticks */ htick(shiftR+(-1,r),shiftR+(-1,-n+1-r)); label("$n$",shiftR+(-1,(-n+1)/2),W,fontsize(10)); htick(shiftR+(-r,-n),shiftR+(n+r-1,-n),(0,0.15)); label("$n$",shiftR+((n-1)/2,-n),S,fontsize(10)); htick(shiftR+(n-r,-n),shiftR+(n+r,-n),(0,0.15)); label("$1$",shiftR+(n,-n),S,fontsize(10)); [/asy]  Mission: I prepare for my career and calling through community, academic experiences, and technology.  MAT 303: Mathematical formulas are often taken for granted, but why should someone put such faith in a formula? Mathematics is the only field of study outside of theology to claim a proclamation of absolute truth. In MAT 303, students will learn how prove things in an attempt to verify truth. Logic and several proof techniques will be presented, and no mathematician’s education is complete without an understanding of ‘proof’ |

Course Engagement: The goal of our course is to learn, and learning math happens by *doing* math. Come to class ready to **engage**. Provide solutions, work with others, have a good attitude, and **ask questions!**

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| Key Dates:  2/3 Eyes of Faith: Proof and Truth 2/6 Exam 1  2/27 Exam 2 4/6 Mathigon Graph Theory Lab 4/6 Arduino Logic Gate Lab 4/20 Final 8:30-10:30 | Note about Proofs Long-Form:  Our textbook is full of mathematical knowledge, historical anecdotes, pro-tips, clever witticisms, funny footnotes, additional examples, and introductions to additional topics. We will not have time to cover everything in class.  Reading the textbook on your own in addition to our class activities is the best practice. | Eyes of Faith    Related image |
| Canvas:  This syllabus, assignments, and grades will be distributed through Canvas. | Microsoft Teams: Class communication will be conducted through the Discrete Math team via Microsoft Teams. The link will be emailed out. Be sure to join the team and turn on notifications. | Grade Report:  A report with your **official grade** status will be emailed to you weekly. Be sure to ask questions if you need any help interpreting your grade. |

How do I get a grade? This course will use **standards-based grading** which is a system that you may not be used to. The two key ideas of standards-based grading is (1) no partial credit and (2) anything that is incorrect can be reattempted.   
The benefits of this systems is that **you control your grade.** The guidelines below describe exactly how to get a grade. Overall, this system should be **less stressful** for you. Not having partial credit may seem scary, but your grade is determined by your accomplishments on your best day, not just what you remember on a particular day, as is the case with grades focused on exam scores.

Your grade will be calculated based upon your demonstrated level of mastery of our course’s **Learning Targets** that are divided into four categories. We have **6 A-Targets (Proof Techniques), 16 B-Targets (Calculations), 5 C-Targets (Complementary), 5 D-Targets (Definitions)**. Additionally, **Homework,** and the **Final Exam** factor in. More detail about these targets is provided below.

Mastery of a learning target is earned by scoring two ✓ grades on that specific target. Students will have multiple attempts to show mastery for each learning target by scoring and maintaining a ✓.

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| Assignments: | Grading Rubric: | |
| Exercises for specific learning targets will be given through in-class quizzes, group quizzes, and tests and graded according to the rubric. | ✓  🗶  ✓- | **mastery**: solid understanding with no errors  **not there yet:** insufficient attempt, no attempt, or late attempt  **almost mastery:** solid understanding but with minor errors given in very limited circumstances. A ✓- grade will be counted as a ✓ only after resubmitting the work with a clear explanation of the mistake and how to correct it. |

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| A-Targets: | Grading Rubric: | |
| To earn ✓, students must score a 3 or higher. | 4  3  2  1  0 | Flawless  Mostly correct, minor errors  Mostly correct idea with poor communication  Incorrect  No attempt |

What do assignments look like? Learning targets can be practiced with homework assignments and mastered through in-class quizzes (sometimes group quizzes), in-class exams, and requested reassessments. A ✓ is awarded for each learning target covered for thoughtful, well-communicated, and successful solutions to these exercises.

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| Homework:  After each lesson, a set of exercises or proofs covering specified learning targets will be assigned to be due the Monday of the following week. | Quizzes: Frequently, we will have an in-class quiz (sometimes in groups) covering a specified learning target. | Exams:  Exams will feature several learning targets. Think of exams as a collection of quizzes. |

I can retake assignments? Yes! Standards-based grading is about actually learning the material and not rewarding a collection of points. Students can request one quiz **(called a ‘reassessment’)** outside of class a week over a specified learning target.

On **Tuesday** and **Thursday** afternoons, students can take a quiz at Dr. Estes’ office. **Requests must be made the day before**. **No walk-ins.** The new score will be recorded as the latest attempt. (If Tuesday or Thursday afternoons do not work for serious scheduling conflicts, let Dr. Estes know to work out arrangements.) **Each requested quiz must be a unique target.** In other words, the same target cannot be attempted multiple times on the same day.

Tokens: Students can trade tokens to earn additional quiz attempts. Each student starts the semester with two tokens and can earn more tokens as opportunities arise. More tokens can be earned through the following means:

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| MFT Quizzes:  A student receives one token for each MFT Quiz question answered correctly. If someone in the class gets all of the MFT Quiz questions correct, then the entire class receives a token! | Homework, MCS, and Seminars:  Turning in homework on time, writing the MCS Mission Statement on exams, and attending seminars all warrant a token as well. |

So… what is my grade? Grades are tallied according to the following scale and weights.

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| --- | --- | --- | --- | --- |
|  | A | B | C | D |
| A-Targets✓✓ | 6/6 (100%) | 5/6 (83%) | 4/6 (67%) | 3/6 (50%) |
| B-Targets✓✓ | 14/16 (87.5%) | 13/16 (81%) | 12/16 (75%) | 11/16 (69%) |
| C-Targets✓ | 16/18 (88%) | 15/18 (83%) | 14/18 (77.8%) | 12/18 (67%) |
| D-Targets✓✓ | 5/5 (100%) | 4/5 (80%) | 3/5 (60%) | 2/5 (40%) |
| Final Exam✓ | 9/10 (90%) | 8/10 (80%) | 7/10 (70%) | 6/10 (60%) |
| HW✓ | 75% | 70% | 65% | 60% |
| One ✓ | 21/22 (95%) | 19/22 (86%) | 18/22 (81%) | 17/22 (77%) |

Your final grade… is calculated with a GPA scale and with these weights: .25(A-Target Grade) + .20 (B-Target Grade) + .15 (C-Target Grade) + .05 (D-Target Grade) + .10(Final Exam) + .20(HW Grade) + .05(One ✓ Grade). (See Example Grade Report below)

The GPA scale… is translated as such: 3.7-4 A; 3.5-3.69 A-; 3-3.49 B; 2.7-2.9 B-; 2-2.69 C; 1-1.99 D; 0-0.99 F  
  
What about the Final Exam? At the end of the course, each student must complete a 10 question, comprehensive exam. In addition to the 10-question exam, one exercise for each B-Target will be made available to support your B-Target grade.

Rubrics and Complementary Targets:

Complementary Targets are additional tasks that enrich the course experience. Some of these are more involved than others and are scored through provided rubrics (in Canvas). Your course will include the following targets with associated points:

C.1 Early Checklist (1)  
C.2 Eyes of Faith: Proof and Truth (5)  
C.3 Mathigon: Graph Theory (3)  
C.4 Arduino Logic Project (6)  
C.5 MFT Quizzes (3)

Project Week: Projects assigned in courses offered by the Mathematics Department are due by the end of Project Week. It is highly encouraged to be proactive on these projects. Late submissions will not be accepted.

Example Grade Report:

**A-Targets:**

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| --- | --- | --- | --- | --- | --- |
|  | Score | Attempts |  | Score | Attempts |
| A.1 | 2 | 3 | A.4 | 2 | 2 |
| A.2 | 2 | 2 | A.5 | 2 | 3 |
| A.3 | 1 | 2 | A.6 | 2 | 4 |

**B-Targets:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Score | Attempts |  | Score | Attempts |
| N.1 | 2 | 3 | CO.1 | 1 | 3 |
| N.2 | 2 | 2 | CO.2 | 1 | 4 |
| N.3 | 2 | 2 | CO.3 | 1 | 2 |
| N.4 | 1 | 2 | L.1 | 2 | 2 |
| S.1 | 2 | 2 | L.2 | 2 | 2 |
| S.2 | 2 | 4 | L.3 | 2 | 3 |
| S.3 | 1 | 3 | L.4 | 2 | 3 |
| S.4 | 2 | 4 | L.5 | 2 | 3 |

**C-Targets:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Score | Max Points |  | Score | Max Points |
| C.1 | 1 | 1 | C.4 | 5 | 6 |
| C.2 | 3 | 5 | C.5 | 3 | 3 |
| C.3 | 3 | 3 |

**D-Targets:**

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| --- | --- | --- | --- | --- | --- |
|  | Score | Attempts |  | Score | Attempts |
| D.1 | 2 | 2 | D.4 | 2 | 2 |
| D.2 | 2 | 2 | D.5 | 0 | 1 |
| D.3 | 2 | 3 |

**Homework Completed (Percentage):** 65% **Final Exam:** 70%

**Tokens Available:** 4

This student mastered 5/6 A-Targets, 11/16 B-Targets, 15/18 C-Targets, 4/5 D-Targets, 70% on the Final Exam, completed 70% of the homework and had at least one ✓ on 22/22 A- and B-Targets.

So she scored letter grades of B (A-Targets), D (B-Targets), B (C-Targets), B (D-Targets), C (Final Exam), B (HW %), A (One-Check). With a GPA Scale (4 for A, 3 for B, 2 for C, 1 for D, 0 for F) and our specified weights, her final grade is calculated by .25(B) + .20(D) + .15(B) + .05(B) + .10(C)+ .20(B) + .05(A) =

.25(3) + .20(2) + .15(3) + .05(3) + .10(2) + .20(3) + .05(4) = 2.75 (B-)

Learning Targets:   
**A-Targets (Proof Writing Techniques)**

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| Learning Target | Cummings | Hammack |
| A.1 Direct Proof (Including Cases) | 2 | 4 |
| A.2 Proofs with Sets | 3 | 8 |
| A.3 Contrapositive and Counterexample | 6 | 5 |
| A.4 Contradiction | 7 | 6 |
| A.5 Mathematical Induction | 4 | 10 |
| A.6 Classical Proofs | 7 | 6 |

**B-Targets (Calculations)**

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| **Number Theory** | Cummings | Hammack |
| N.1 Divides, GCD, LCM | 2.2, 2.3, 2.4, p85 | 4.3 |
| N.2 Modular Arithmetic | 2.5 | 5.2 |
| N.3 Floor and Ceiling | Supplement | Supplement |
| N.4 Fibonacci Numbers | p199 | 10.5 |
| **Sets** |  |  |
| S.1 Determine Subsets, Unions, and Intersections of Sets | 3.1, 3.4 | 1.1, 1.3, 1.5, 1.8 |
| S.2 Determine Set Subtraction and Set Compliment | 3.4 | 1.6, 1.7 |
| S.3 Power Sets | 3.4 | 1.4 |
| S.4 Cartesian Products | 3.4 | 1.2 |
| **Counting** |  |  |
| CO.1 The Multiplication and Addition Principles |  | 3.2, 3.3 |
| CO.2 Permutations and Combinations |  | 3.4 |
| CO.3 Pascal’s Triangle and the Binomial Theorem |  | 3.6 |
| **Logic** |  |  |
| L.1 Statements and Compound Statements | 5.1 | 2.1, 2.2, 2.3 |
| L.2 Converse and Contrapositives | 5.1, 5.3, 6.1 | 2.2 |
| L.3 Truth Tables (Simple) | 5.2 | 2.2 |
| L.4 Truth Tables (Complex) | 5.2 | 2.5 |
| L.5 Statements with Quantifiers and Negations | 5.3 | 2.7, 2.10 |

**C-Targets (Complementary)**

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| C.1 Exam 1 Checklist (to be completed before first Exam) |
| C.2 Eyes of Faith: Proof and Truth (rubric on Canvas) |
| C.3 Mathigon: Graph Theory Lab |
| C.4 Arduino Logic Project |
| C.5 MFT Quizzes (3) |

**D-Targets (Definitions)**

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| Learning Target | Cummings | Hammack |
| D.1 Chapter 2 Definitions | 2 |  |
| D.2 Chapter 3 Definitions | 3 |  |
| D.3 Counting and Fibonacci Definitions | p199 | 3, 10.5 |
| D.4 Chapter 5 Definitions | 5 |  |
| D.5 Chapter 8 Definitions | 8 |  |