Instructor  Wil Clarke. Office: 256 Price Science Center, Phone x2548; home phone 951-687-4556, please don’t call after 10:00 p.m. e-mail: wclarke@lasierra.edu. Web page: http://faculty.lasierra.edu/~wclarke. My office hours are listed below and posted on my office door. If those are inconvenient, please let me know and we’ll find a time to meet that is convenient to each of us.


Bulletin Description  This course examines how mathematics applies to real-world problems. Applications will be chosen from topics such as: methods of voting and of apportionment; the mathematics of money; probability; paths and networks; number theory; games; truth tables and arguments; and tessellations and polyhedra. not apply toward any mathematics or computer science program. Prerequisite: MATH 007 or appropriate score on placement examination.

Objectives  1. To attain a better understanding of some rich mathematical ideas.
    2. To build sharper skills for analyzing life issues that transcend mathematics.
    3. To develop a new perspective and outlook on the way you view the world

Course Requirements  1. Homework: Homework exercises will be assigned for most class periods. I will check each problem and provide you with feedback on them, but your grade will be based solely on how much effort is evident in the work you turn in; your grade on each assignment will be a 4 (all problems solved, with complete but not necessarily correct solutions), 3 (all problems attempted, with significant progress towards solutions), 2 (not all problems attempted, or no significant progress towards solutions on any problem), or 0 (assignment not turned in). If you get a 3 on every homework assignment, you will get a B for your homework grade. For the most part you are encouraged to collaborate with other students in the class while doing your homework. However, you must write up your own solutions using your own words. If you do collaborate this collaboration should be acknowledged. Your homework must be word-processed. Your answers must appear in full sentences in good English. (If your English is weak, find someone to help you edit your work.) Homework is due at the beginning of the class period on its due date.
    2. Quizzes: A five minute quiz at the beginning of each class period may be instituted. If you miss it, you will not be able to make up this quiz for any reason. Leaving class early may result in your losing quiz points.
    3. Exams: There will be two exams for this course: a midterm and a final. The exam problems will be comparable in difficulty to homework exercises and problem sets. The final exam will be comprehensive, and your score on the final exam will replace your score on the midterm if your midterm score is lower. The midterm exam is on Monday, May 4, during regular class time, and the final is on Thursday, June 11, at 11:00 a.m.
    4. Research Project/Poster Session: The only way to really understand mathematics is to learn and discover it on one's own. Thus, students will select a mathematical topic outside of those covered in our class, read and teach themselves any necessary background to understand it, and then investigate the topic. Students are strongly encouraged to work together in groups of two or three on this project. By working together, the individuals can learn from each other and share the experience. Each group will write a final paper on their findings and present a poster display during a class poster session at the end of the semester. Also, each student will write a short individual statement regarding the experience. Various interim reports will be collected throughout the term. Students are invited and encouraged to discuss all phases of the project with me.
    5. Participation: Since mathematics is not a spectator sport you are expected to
participate in class. Mike Starbird notes; “If you don’t try, it’s hard to fail.” Since your participation is expected, you should do the best you can to participate well. By the end of the term I want to know the sound of everyone’s voice. However, you should not expect to have the right answer all the time. If you were able to always have the right answer there would be no need for you to take the course. Thus, when you come around to answer a question, any answer is fine except “I don’t know.” Ed Burger reminds us to “Make mistakes and fail, but never give up.” Learning from failed attempts is one of the most powerful means toward understanding issues and creating innovative ideas. I want you to make mistakes and fail and then learn from those attempts in class and beyond. In fact, it counts 5% of your grade. Missing class for any reason will have a negative effect on your grade. Changes in this syllabus become effective after being announced to the class. You are responsible for these, even if you were absent when the changes were announced. Please have your cell phones, beepers, pagers, etc in silent mode during class. Do NOT answer these inside the classroom.

Plagiarism and Cheating The following statement is taken from the Academic Integrity Faculty Manual of La Sierra University (Spring 2009)

All students are expected to read and honor the Academic Integrity Policy, which is printed in the University Bulletin. As stated in the preamble, “embracing the principles of Academic Integrity...provides a vital foundation for this community of scholars and its larger society.”

By attending the University, you have agreed to the following statement:

I will act with integrity and responsibility in my activities as a La Sierra University student or faculty member.

I will not participate in violations of academic integrity, including plagiarism, cheating, or fabricating information. I will not stand by when others do these things. I will follow the academic integrity policy.

Plagiarism is defined in the Academic Integrity Policy as follows:

Plagiarism occurs when a writer appropriates another’s ideas without proper acknowledgement of the source or uses another’s words without indicating that fact through the use of quotation marks.

Note that while some assignments may be done in collaboration with a classmate, most should be done individually. If you have any questions about your assignment, plagiarism, or the Academic Integrity Policy, always ask your instructor! [Adapted from William R. Morgan, The College of Wooster]

You are encouraged to seek assistance from faculty or students in doing your homework. However work that is done primarily by someone else is unacceptable and may result in your failing the course. Plagiarism and/or cheating on tests, exams or papers means an automatic zero on that occasion, a letter to the dean, and possible further disciplinary action.

Final examination schedule note from the CAS bulletin “A four-day examination schedule allowing a two-hour period for each class is printed in the schedule of classes. Students are required to take the scheduled final examination at the appointed time and place in order to secure credit. . . . Exceptions to the examination schedule are granted only for emergency situations.” You must contact the CAS Dean for permission to take the final exam at a non-scheduled time.

Disability La Sierra University complies with the Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act of 1973. Any student with a documented disability (physical, learning, or psychological) needing academic accommodations should contact the Office of Disability Services (ODS) as early in the quarter as possible. All discussions will remain confidential. Please contact the ODS (La Sierra Hall, Suite 100 – x2450) for additional information. Students who qualify for accommodations, must bring their ODS paperwork to their instructor no less than 3 school days before they wish such accommodations to take effect.

Learning Support Center Tutors are available at the Learning Support Center. Videos and computer help is also available. Please make use of every aid provided.

Grading Scheme

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<thead>
<tr>
<th>Grade Assignment</th>
<th>Homework</th>
<th>10%</th>
<th>90—100%</th>
<th>A range</th>
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</thead>
<tbody>
<tr>
<td>Exams</td>
<td>60%</td>
<td>80—89%</td>
<td>B range</td>
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</tr>
<tr>
<td>Participation</td>
<td>5%</td>
<td>65—79%</td>
<td>C range</td>
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</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
<td>50—64%</td>
<td>D range</td>
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<tr>
<td>Project</td>
<td>15%</td>
<td>0—49%</td>
<td>F</td>
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</tbody>
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There are no such grades as “C–” or “D–” in this class.

Outline:
Chapter One: Fun and Games: An Introduction to Rigorous Thought

Week 1 30-Mar 1.1 Silly Stories each with a Moral: Conundrums That Evoke Techniques of Effective Thinking
Which Chapter would you like to study most? Why?

Week 1 31-Mar 1.2 Nudges: Leading Questions and Hints for Resolving the Stories
Solve all of the stories in 1.1

Week 1 2-Apr 1.3 The Punch Lines: Solutions and Further Commentary

Week 1 1.4 From Play to Power: Discovering Strategies of Thought for Life
Do 5 of the Mindscapes in 1.4 not including numbers 1, 2, and 4

Chapter Seven: Taming Uncertainty

Week 1 3-Apr 7.1 Chance Surprises: Some Scenarios Involving Chance That Confound Our Intuition
Mindscapes 7.1: 1-12, 14, 15

Week 2 6-Apr 7.2 Predicting the Future in an Uncertain World: How to Measure Uncertainty Using the Idea of Probability
Mindscapes 7.2: 1-8, 10, 14, 17, 19-21, 26-28, 34, 37, 39

Week 2 7-Apr 7.3 Random Thoughts: Are Coincidences as Truly Amazing as They First Appear?
Mindscapes 7.3: 1-7, 9 or 19, 10 or 11, 16, 22, 25, 26, 30, 32, 34, 35, 37

Week 2 9-Apr 7.4 Down for the Count: Systematically Counting All Possible Outcomes

Week 3 13 Apr 7.5 Collecting Data Rather Than Dust: The Power and Pitfalls of Statistics
Mindscapes 7.5: 1-6, 8-10, 13, 17, 19-22

Week 3 7.6 What the Average American Has: Different Means of Describing Data
Mindscapes 7.6: 1-7, 10, 12, 22-24, 31, 33 / Questions on Survey 7.6: 13-18, 35

Week 3 7.7 Parenting Peas, Twins, and Hypotheses: Making Inferences from Data

Chapter Eight: Deciding Wisely: Applications of Rigorous Thought

Week 3 14 Apr 8.1 Great Expectations: Deciding How to Weigh the Unknown Future
Mindscapes 8.1: 1-7, 9, 10, 12, 13, 16, 17, 22, 27, 28, 37, 39

Week 3 16-Apr 8.2 Risk: Deciding Personal and Public Policy
Mindscapes 8.2: 1-5, 11-13, 16-18, 21, 22

Week 4 20-Apr 8.3 Money Matters: Deciding Between Faring Well and Welfare
Mindscapes 8.3: 1-8, 11, 16, 18, 22

Week 4 21-Apr 8.4 Peril at the Polls: Deciding Who Actually Wins an Election
Mindscapes 8.4: 1-9, 16-18, 21, 22

8.5 Cutting Cake for Greedy People: Deciding How to Slice Up Scarce Resources

Chapter Two: Number Contemplation

Week 4 23-Apr 2.1 Counting: How the Pigeonhole Principle Leads to Precision Through Estimation
Mindscapes 2.1: 1-9, 13, 16, 20, 22
24-Apr  Clear your project (subject and members) with me

Week 5  27-Apr  2.2 Numerical Patterns in Nature: Discovering the Beauty of the Fibonacci Numbers
           Mindscapes 2.2: 1-7, 10, 15, 18-22, 29, 30

        2.3 Prime Cuts of Numbers: How the Prime Numbers Are the Building Blocks of All Natural Numbers
           Mindscapes 2.3: 1-11, 14, 27, 29, 37

        2.4 Crazy Clocks and Checking Out Bars: Cyclical Clock Arithmetic and Bar Codes

        2.5 Public Secret Codes and How to Become a Spy: Encrypting Information Using Modular Arithmetic and Primes

Week 5  28-Apr  2.6 The Irrational Side of Numbers: Are There Numbers Beyond Fractions?
           Mindscapes 2.6: 1-8, 11, 26, 29, 39

        2.7 Get Real: The Point of Decimals and Pinpointing Numbers on the Real Line

4-May  Midterm Examination on Chapters 1, 2, 7, 8

Chapter Three: Infinity

Week 6  5-May  3.1 Beyond Numbers: What Does Infinity Mean?
           Mindscapes 3.1: 1-10, 16, 17, 21, 22

Week 6  8-May  3.2 Comparing the Infinite: Pairing Up Collections via a One-to-One Correspondence
           Mindscapes 3.2: 1-8, 11, 15, 20, 27, 31, 36, 37

Week 7  11-May  3.3 The Missing Member: Georg Cantor Answers: Are Some Infinities Larger Than Others?
           Mindscapes 3.3: 1-9, 13, 16, 21

Week 7  12-May  3.4 Travels Toward the Stratosphere of Infinities: The Power Set and the Question of an Infinite Galaxy of Infinities
           Mindscapes 3.4: 1-6, 8, 9, 13, 16, 17, 21

           3.5 Straightening Up the Circle: Exploring the Infinite Within Geometrical Objects

Chapter Five: Contortions of Space

Week 7  14-May  5.1 Rubber Sheet Geometry: Discovering the Topological Idea of Equivalence by Distortion
           Mindscapes 5.1: 1-8, 11, 12, 19, 22, 26, 29, 34, 37

Week 7  15-May  Make Progress Report on your Project

Week 8  18-May  5.2 The Band That Wouldn’t Stop Playing: Experimenting with the Möbius Band and Klein Bottle
           Mindscapes 5.2: 1-10, 13, 22, 26, 36

Week 8  19-May  5.3 Feeling Edgy? Exploring Relationships Among Vertices, Edges, and Faces
           Mindscapes 5.3: 1-8, 16-20, 22, 24, 26, 29, 39, 30, 36

Week 8  21-May  5.4 Knots and Links: Untangling Ropes and Rings

           5.5 Fixed Points, Hot Loops, and Rainy Days: How the Certainty of Fixed Points Implies Certain Weather Phenomena

Chapter Four: Geometric Gems
4.1 Pythagoras and His Hypotenuse: How a Puzzle Leads to the Proof of One of the Gems of Mathematics

4.2 A View of an Art Gallery: Using Computational Geometry to Place Security Cameras in Museums

4.3 The Sexiest Rectangle: Finding Aesthetics in Life, Art, and Math Through the Golden Rectangle

4.4 Smoothing Symmetry and Spinning Pinwheels: Can a Floor Be Tiled Without Any Repeating Pattern?

29-May Make Progress Report on your Project

4.5 The Platonic Solids Turn Amorous: Discovering the Symmetry & Interconnections Among the Platonic Solids

4.6 The Shape of Reality? How Straight Lines Can Bend in Non-Euclidean Geometries

4.7 The Fourth Dimension: Can You See It?

Week 10 4-Jun Present your Poster and Research Report to the Class

* Last day to drop a class with no record on transcript is Friday, April 10.
§ Last day to drop a class with a “W” grade is Friday, May 22.

Final Exam Thursday June 11, 11:00 a.m.

Ει δε τις υμῶν λειπεῖται σοφίας, αἰτεῖτω παρὰ τοῦ διδόντος Θεοῦ πάσιν ἀπλῶς καὶ μη ονειδίζοντος, καὶ δοθῆσεται αὐτῷ.  
James 1:5 (Nestle & CEV)

If any of you need wisdom, you should ask God, and it will be given to you. God is generous and won’t correct you for asking.
Recognizing that good teaching is based on three underlying principles: “plagiarize, plagiarize, & plagiarize” ideas in this syllabus have been borrowed shamelessly from Ed Burger, Andrew Miller, and Ron Taylor.