POINT 19 02 LOMA
NAZARENE UNIVERSITY

Mathematics, Information, and Computer Sciences – School of STEM

MTH3003-3 Problem Solving

3 units

Spring 2025

Tuesdays and Thursdays, 2:30 pm – 3:45 pm

Liberty Station, Room 202

Final Exam: Main Room Liberty Station on Friday May 9 1:30 pm – 4:00 pm

Information	Specifics for the course
Instructor name and title:	Prof. Elizabeth Crow
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Office location and hours:	Rohr Science 234 or ZOOM See Times in Canvas

PLNU MISSION: TO TEACH ~ TO SHAPE ~ TO SEND

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

GENERAL EDUCATION

PLNU provides a foundational course of study in the liberal arts informed by the life, death, and resurrection of Jesus Christ. In keeping with the Wesleyan tradition, the curriculum equips students with a broad range of knowledge and skills within and across disciplines to enrich major study, lifelong learning, and vocational service as Christ-like participants in the world's diverse societies and culture.

COURSE DESCRIPTION

A general education course whose major goal is to develop the ability to solve non-routine problems through dynamic processes of inquiry and exploration, logical reasoning, making and testing conjectures and investigating implications of conclusions. A study of quantitative reasoning with emphasis on active problem solving and developing connections with other disciplines. Not applicable toward a major in Mathematics.

PROGRAM AND COURSE LEARNING OUTCOMES

- Students will be able to formulate a mathematical model from a verbal description of a problem.
- Students will be able to solve non-routine problems using logic and quantitative techniques.
- Students will be able to construct solutions to problems using computational techniques

GENERAL EDUCATION LEARNING OUTCOMES

- Link to GE courses and corresponding GELO's: https://assessment.pointloma.edu/academic-assessment/general-education/assessment-plan/

- *GELO 1e: Students will be able to solve problems that are quantitative in nature. A group project will be used to assess this learning outcome.*
- *Signature Assignment: Questions on the Final Exam*

REQUIRED TEXTS AND RECOMMENDED STUDY RESOURCES

Students are responsible for having the required course textbooks prior to the first day of class.

All supplemental materials posted on this course site (including articles, book excerpts, or other documents) are provided for your personal academic use. These materials may be protected by copyright law and should not be duplicated or distributed without permission of the copyright owner.

Textbook: Excursion in Modern Mathematics, 10th Edition (Electronic Copy via My Lab and Mastering)
Author: Peter Tannenbaum
Publisher: PEARSON

COURSE CREDIT HOUR INFORMATION
In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, this class meets the PLNU credit hour policy for a 3-unit class delivered over 15 weeks. It is anticipated that students will spend a minimum of 37.5 participation hours per credit hour on their coursework. For this course, students will spend an estimated 112.5 total hours meeting the course learning outcomes. The time estimations are provided in the Canvas modules. Specific details about how the class meets the credit hour is provided below.

Online Homework	20.00
Written Homework	20:00
Reading Text/ Watching videos	30.00
Group Project	6.00
Budget Project	4.00
Class meetings	30.00
Midterms	2.50
Final Exam	2.50
TOTAL	115.00

ASSESMENT AND GRADING
The grade components are written homework, online homework, projects, class activities, midterm exams, and the final examination.

GRADING SCALE
A passing grade requires getting at least 60% in one of the two tests or on the final exam. Grades are based on the number of points accumulated throughout the course. Approximate minimal percentages required to obtain a given grade are:

Grading Scale in Percentages				
	A	B	C	D
+		(87.5, 90]	(77.5, 80]	(67.5, 70]
	(92.5, 100]	(82.5, 87.5]	(72.5, 77.5]	(62.5, 67.5]
−	(90, 92.5]	(80, 82.5]	(70, 72.5]	[60, 62.5]

GRADING DISTRIBUTION

Grade Distribution	
Two Midterms scored at 17.5%	35%
Final Exam (Cumulative)	25%
Online Assignments (OA)	10%
Group Project	5%
Individual Budget Assignment	5%
Written Homework	13%
Class Activities	7%
Total	100%

FINAL EXAMINATION POLICY

Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on the Traditional Undergraduate Records: Final Exam Schedules site. If you find yourself scheduled for three (3) or more final examinations on the same day, you are authorized to contact each professor to arrange a different time for one of those exams. However, unless you have three (3) or more exams on the same day, no requests for alternative final examinations will be granted.

OTHER FACTORS THAT AFFECT GRADES

- **Online Assignments:** Online assignments (OA) will be completed in Access Pearson and Mastering website. This will be available by purchasing an access code (this should be included with your e-textbook).

- **Written Homework:** Assignments collected must be prepared in a style suitable for grading. The following guidelines are used to determine credit:
  - the organization must be easy to follow
  - the work must be legible
  - complete solutions must be written for problems (not just answers); answers must be clearly marked
  - use complete sentences to answer questions

- **Tests and Final Examination:** Tests and the final exam will include problems and questions over material assigned in the text, readings and handouts, as well as material presented in class. No examination shall be missed without prior consent or a well-documented emergency beyond your control. A score of zero will be assigned for an examination that is missed without prior consent or a

well-documented emergency beyond your control. The examination schedule is included in the daily schedule. This instructor does not intend to accept excuses such as poor communication with parents, benefactors, surf team sponsors and/or travel agents.

INCOMPLETE AND LATE ASSIGNMENTS

- All assignments are to be submitted/turned in by the due date and time —including assignments posted in Canvas. **Late work need not be accepted.**
- Make-up tests will be given only by prior arrangement with the instructor for reasons of documented emergency.
- **Incomplete grade:** Incompletes will only be assigned in extremely unusual circumstances. You may request a grade of I (incomplete) only if you are having a passing grade and at least 70% of the course work is completed.

Written Homework AT – A – GLANCE

These assignments are to be written up on paper or a PDF uploaded to CANVAS on or before the due date.

Chapter	Page	Problems	Due Date
1	29 – 37	# 4, 16, 30, 38, 50, 52	1/31/2025
2	60 – 67	# 4, 18, 36, 58, 60, 64	2/7/2025
4	126 – 134	# 4, 16, 20, 26, 34, 40	2/21/2025
5	162 – 171	# 6, 10, 30, 46, 54, 56	3/7/2025
6	194 – 203	# 6, 14, 34, 40, 44, 52	3/21/2025
7	219 – 225	# 6, 20, 26, 40, 42, 50	3/28/2025
8	246 – 255	# 30,36, 40, 54, 56, 58	4/11/2025
10	322 – 326	# 20, 36, 50, 60, 62, 70	5/2/2025

Comments on homework:

1. This is the minimum amount of homework that is required but you may need to do several odd numbered problems to make sure you get the answer in the textbook.
2. Be sure to upload a scanned copy of your homework before the deadline. No late homework will be accepted except by prior arrangement or with a documented emergency. Please be sure that your scanned homework is legible and not in HEIC format (PDF or JPEG are good).
3. Homework will be scored on a combination of completeness and correctness. All work necessary to complete a problem must be shown to earn credit.
4. Start working on your homework early. These problems are difficult and meant to be done a little at a time over the course of a few days.
5. When doing homework, please note it is normal to not be able to do every problem correct on the first attempt. Do not be discouraged, instead seek help.

Artificial Intelligence (AI) Policy

You are allowed to use Artificial Intelligence (AI) tools (e.g., ChatGPT, Gemini Pro 1.5, Grammarly Go, Perplexity, etc.) to generate ideas, but you are not allowed to use AI tools to generate content (text, video, audio, images) that will end up in any work submitted to be graded for this course. If you have any doubts about using AI, please gain permission from the instructor.

PLNU ACADEMIC ACCOMMODATIONS POLICY

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities in accordance with the Americans with Disabilities Act (ADA). Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center (EAC@pointloma.edu or 619-849-2486). Once a student's eligibility for an accommodation has been determined, the EAC will work with the student to create an Accommodation Plan (AP) that outlines allowed accommodations. The EAC makes accommodations available to professors at the student's request.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course. Accommodations are not retroactive so clarifying with the professor at the outset is one of the best ways to promote positive academic outcomes.

Students who need accommodations for a disability should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. It is the student's responsibility to make the first contact with the EAC. Students cannot assume that because they had accommodations in the past, their eligibility at PLNU is automatic. All determinations at PLNU must go through the EAC process. This is to protect the privacy of students with disabilities who may not want to disclose this information and are not asking for any special accommodations.

PLNU ATTENDANCE AND PARTICIPATION POLICY

Regular and punctual attendance at all class sessions is considered essential to optimum academic achievement. If the student is absent for more than 10 percent of class sessions, the faculty member will issue a written warning of de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university withdrawal date or, after that date, receive an "F" grade.

Additional Course Information:

Additional PLNU policies and practices that apply to this course can be found at the following link: https://docs.google.com/document/d/18i1pUoY0iCfB8w7JKxVvACQW309X-JRB/edit?usp=sharing&ouid=116164865489739533893&rtpof=true&sd=true

Daily Schedule:

Week	In class - Tuesday	In class - Thursday	Due this week
1 1/13-1/17	Introduction to the course and Chapter 1: Introduction to Voting	Chapter 1: Introduction to Voting Alternative Voting Methods	Obtain course materials: Register for MyLab
2 1/20-**1/24**	Chapter 1: Alternative Voting Methods	Chapter 1: Fairness of Voting Methods	**Intro OA** **OA 1.1 -1.5**
3 1/27-1/31	Chapter 2: Introduction to Weighted Voting	Chapter 2: Banzhaf Power Distribution	**OA 1.6, 2.1** **Homework Chapter 1**
4 2/3–2/7	Chapter 2: Shapley- Shubik Power Distribution	Chapter 4: Introduction to Apportionment	**OA 2.2 – 2.4** **Homework Chapter 2**
5 2/10-2/14	Chapter 4: Modified Divisor Methods	Chapter 4: Apportionment and Fairness	**OA 4.1 - 4.4**
6 2/17 – 2/21	Review for Exam #1	**EXAM 1: Chapters 1, 2, 4**	**OA 4.5- 4.6** **Homework Chapter 4**
7 2/24-2/28	Chapter 5: Introduction to Graph Theory	Chapter 5: Street Routing Problems	**OA 5.1 & 5.2** *Begin Group Project
8 3/3-3/7	Chapter 5: Eulerizing and Solving SRP's	Chapter 6: Introduction to Traveling Salesman Problems	**OA 5.3 -5.4** **Homework Chapter 5**
Spring Break: 3/10 to 3/14			
9 3/17 – 3/21	Chapter 6: Algorithms to Solve TSPs	Chapter 7: Introduction to Networks and Trees	**OA 6.1 – 6.5** **Homework Chapter 6**
10 3/24 -3/28	Chapter 7: Kruskal's Algorithm for MST's	Chapter 8: Introduction to Digraphs and Task Processors, Priority Lists and Scheduling	**OA 7.1 -7.3** **Homework Chapter 7**
11 3/31 – 4/4	Chapter 8: Priority Lists and Scheduling	Chapter 8: Critical Paths and Backflow Algorithm	**OA 8.1 – 8.3**
12 4/7 – 4/11	Review for Exam #2	**Exam 2: Chapters 5, 6, 7, 8**	**OA 8.4 -8.5** **Homework Chapter 8**
13 4/14-4/18	Chapter 10: Introduction to Finance & Introduction to the Budget Project	**Easter Break** **No Classes**	*Begin Budget Project*
14 4/21 –4/25	Chapter 10: Introduction to Finance	Chapter 10: Interest and Retirement	**OA 10.1 -10.2** *Begin Budget Project*
15 4/28 – 5/2	Chapter 10: Loan Payment and Amortization	Review	**OA 10.3 -10.5** **Homework Chapter 10**
Finals Week 5/5 – 5/9	**MTH 3003 Final Exam is Friday, May 9, 2024 1:30 to 4:00 pm**		

COURSE PHILOSOPHY

The general method of the course is to involve students in "dynamic processes of inquiry and exploration, logical reasoning, making and testing conjectures, and investigating implications of conclusions" [Catalog]. Specifically, the focus is on the processes and tools of quantitative problem solving. Learning what they are and developing ability to use them.

"Today's world is more mathematical than yesterday's, and tomorrow's world will be more mathematical than today's."

"...mathematics...serves as a key to opportunity and careers."[Everybody Counts, p.45, p.3]

"To participate rationally in a world where discussions about everything from finance to the environment, from personal health to politics, are increasingly informed by mathematics, one must understand mathematical methods and concepts, their assumptions and implications." [50 Hours, p.35]

In view of these statements and many other similar ones from national reports, this quantitative experience (MTH 3003) has been included as part of the PLNU general education curriculum. Thus, all students will study "major concepts, methods, and applications of quantitative reasoning with emphases on active problem solving" [Catalog].

COURSE APPROACH

The ability to solve problems requires resourcefulness, flexibility, and efficiency in dealing with new obstacles. Research on

teaching and learning problem solving suggests that certain factors are critical to successful problem solving, including resources, heuristics, control, and belief systems [Schoenfeld, 1985].

Resources refer to whatever information problem solvers understand (or misunderstand) that might be brought to bear on a problem.

Heuristic refers to strategies and techniques problem solvers have (or lack) for making progress when working on non-routine problems.

Control refers to the way problem solvers use (or fail to use) the information at their disposal.

Belief systems refer to the problem solver's "world view" of the problem domain, which determines the ways they use the knowledge in the first three categories.

The approach in MTH 303 develops and uses these factors to increase your problem-solving ability. Classroom techniques used include:

- the teacher as role model
- whole-class problem solving with teacher as control
- small-group problem solving with teacher as coach

In addition, you are assigned readings and problems that will help you identify and make progress in the four areas discussed above.

COURSE METHODS

- *Use of groups:* There is almost a century of research showing that academic achievement, productivity, and self-esteem improve dramatically when students work together in groups. This method emphasizes teamwork, cooperation and support by others, rather than isolation and competition in learning.

- *Role of the classroom instructor:* There will be less direct "lecturing" in class than usual, with many questions "answered" by another question to help you work through your own questions and difficulties. You are expected to learn problem solving through active involvement - reading, writing, and explaining to others what you are thinking and doing.

This may require some adjustment in the way you think about teaching and learning. Initially, you may wish for more direct information and answers, but your patience and effort will be rewarded with a deeper understanding and increasing independence in problem solving, as well as confidence in your ability to tackle new problems.

REFERENCES

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