

Paradox: Mathematics of Nonsense

TCORE 102 B

SLN # 21780

Class Meets: MWF 11-12:20 PM in BHS 103

Course Website: <https://canvas.uw.edu/courses/1225624>

Office Hours @ MDS 210C Tue 1:30-3:30 or by appointment

@ TLC: Wed 1:30-3:30

Fall 2018

Lecturer: Alan Bartlett

Office: MDS 210C

e-mail: alanmb@uw.edu

Office Phone: 253-692-5692

Course Description: A *paradox* is a proposition which leads to consequences or results which are strikingly counter to intuition or established results. This is a course that explores and analyzes different types of paradoxes and their resolutions. We will study self-referential paradoxes, paradoxes in probability, statistics, graph, and voting theory, as well as visual paradoxes, paradoxes involving infinity, and many others.

Basic Expectations:

- Actively engage in all class activities and discussions, asking relevant questions.
- Be respectful of others rights to speak and present positions.
- Criticize the argument made, not the person who makes it.

Recommendations for Success:

- **Prepare:** scan relevant sections of the book or look at the recommended videos before lecture, and look at homework and practice materials early. Seeing the material in advance helps you put things into context as you learn.
- **Communicate:** mathematics is a language for problem solving, you need to express it to become fluent with it. Let myself or others around you know when you do, or do not understand something!. Do not be ashamed or afraid to ask questions in or out of class, or ask your peers, tutors, or other instructors to justify or explain claims that are made.
- **Be Present:** falling behind makes it harder to keep up. While attendance is not required, it is important to keep up with the content, and being in class is one of the best ways to do that. Use Canvas and be proactive about deadlines.
- **Grow:** no one is born with mathematical fluency - it is developed thru participation, persistence, and practice. Don't be afraid to make mistakes, ask questions, or offer suggestions - they are equally significant requisites for learning.
- Come to class every day, on time, and ready to go.
- Check Canvas regularly; enable *notifications* there to get updates via email.
- Watch recommended videos, do readings, and turn in assignments on time!
- Read instructions, ask for clarification anytime you don't understand something.
- Participate fully in classroom conversations and activities.
- Be respectful of your peers as well as your instructor.
- Promote a good learning environment by having a good attitude towards learning.

Student Learning Objectives: by the end of the course you should be better at

1. interpreting mathematical models and drawing inferences.
2. representing mathematical information symbolically, visually, numerically, and verbally.
3. using arithmetic, algebraic, geometric, and statistical methods to solve problems.
4. estimating and checking answers to math problems in order to determine reasonableness, identify alternatives, and select optimal results.
5. recognizing that mathematical and statistical methods have limits.
6. synthesizing varied resources to develop a coherent understanding of a topic.
7. identifying and understanding logical fallacies, and distinguishing them from good parts of an argument.
8. applying critical thinking skills to everyday life.

Required Texts: Paradoxes in Mathematics by S. Farlow and An illustrated book of Bad Arguments by A. Almosawi.

Course Calendar: The webpage gets updated weekly with information about upcoming topics, assignments, tests, and projects, along with course materials and some related YouTube videos that may be helpful. A daily schedule of topics and assignments is available at on the Syllabus page of the course website, or via your student Canvas calendar page. The calendar may be updated during the course at my discretion, although all updates will be announced in class. A rough order of the topics we will cover in the course:

- | | | | |
|--------------------------|-----------------------------|---------------------------|---------------------------|
| 1. Liar's Paradox | 10. Barber's Paradox | 19. Simpson's Paradox | 28. Chocolate Paradox |
| 2. Introductory Logic | 11. Set Theory | 20. Gerrymandering | 29. Missing \$ Riddle |
| 3. Knights and Knaves | 12. Russell and Goedel | 21. Voting Theory | 30. Zeno's Paradox |
| 4. Two Door Riddle | 13. Monty Hall | 22. Spurious Correlations | 31. Hilbert's Grand Hotel |
| 5. Logical Fallacies | 14. Probability Theory | 23. Prisoner's Dilemma | 32. Library of Babel |
| 6. Logic games | 15. Really Russian Roulette | 24. Game Theory | 33. Tarski's Paradox |
| 7. Unexpected Hanging | 16. St Petersburg Paradox | 25. Friendship Paradox | 34. Geometric Paradoxes |
| 8. Blue-Eyes Riddle. | 17. Birthday Paradox | 26. Graph Theory | 35. Perception Paradoxes |
| 9. Heterological Paradox | 18. Two envelopes paradox | 27. Rope around Earth | 36. Moebius and Klein |

You are responsible for keeping up-to-date with the class calendar and due dates for homework, quizzes, projects, and exams.

Participation: Class activities, discussions, and worksheets contribute to this grade. You are expected to attend class regularly: if you miss a class, it is your responsibility to find out and cover what you missed using Canvas, asking classmates, or office hours. Worksheets for each unit will be due on quiz days (after you've used them to study!)

Project: There will be a group project and presentation at the end of the quarter on a paradox not treated in the course or our texts. You must choose topics and form groups, subject to instructor approval, write a summary paper (2 pages), give a presentation in class (10 minutes), and lead a discussion on your topic.

Final Exam: The final exam is scheduled for Wednesday December 12, 11am-1pm during Finals week. It will be cumulative, covering all topics from class, readings, and worksheets, and is held in our classroom. No makeups are available.

Homework: assigned weekly, and typically due on Mondays at the start of class, or by midnight the same day online. These consist of problems related to the class activities, readings, and worksheets. You are encouraged to work with others, but should be written by you in your own words. Write neatly, and show work for full credit. Late assignments suffer a 50% penalty.

Quizzes: There are three quizzes, scheduled for weeks 4, 7, and 10. They are noncumulative and consist of questions related to in class activities, readings, and homework for each topic. Missed quizzes cannot be made up unless previously arranged.

Course Grades: The following weights will be used to calculate your percentage in the course.

Participation: 10% Project: 15% Final Exam: 20% Homework: 25% Quizzes: 30%

A linear rescaling of the 4.0 scale is applied at my discretion (typically 75% is 2.0, 95% is 4.0, but this is nonbinding).

Office Hours, Contact: All office hours will be held in the Teaching & Learning Center (the TLC). If you are unable to make my posted office hours, I am happy to try and make appointments - come talk to me. I am also typically available before and after class for questions or to address concerns.

Email or Canvas are both appropriate ways to get in touch with me: although I will likely respond more rapidly via email. I can generally be reached between 9am-9pm, and will try to respond within the hour to reasonable questions. If emailing regarding homework questions, please be sure to indicate which homework, and which problem number you are referring to.

If you are ever feeling overwhelmed, please do not hesitate to let me know. Although many students find mathematics stressful, it does not have to be, and I will do whatever is reasonable to help you succeed.

While I have attempted to make this syllabus as complete as possible, adjustments will be made throughout the course. Announcements will be made during class and it is the responsibility of the student to catch up if class is missed.

Miscellaneous Notes:

○ Teaching and Learning Center: Located on the second floor of the Snoqualmie Library, the TLC offers a number of additional instructional services. It provides space for students to work on a variety of topics, and there are tutors available for help on homework or studying. Additionally, there are regular workshops for precalculus and calculus review. More information and details are available at: <http://www.tacoma.washington.edu/tlc/>. For special needs or subject tutoring requests, please email uwttteach@uw.edu or call (253) 692-4417.

– **Registering:** When visiting the TLC for the first time, please sign up at the TLC main desk. During subsequent visits, you can simply swipe your student ID card and select your reason for visiting (tutor, workshop, meet with instructor, etc). Doing this provides a significant benefit to the TLC as a resource, and allows the staff at the TLC to better assess and improve its value to UWT students; your participation in this process is highly appreciated.

○ There will be no tolerance for cheating. All exams and quizzes are to be done individually unless otherwise specified. You are encouraged, however, to work together on the homework and form study groups outside of class.

○ To plagiarize is to use the ideas-or unique phrasings-without acknowledging that they come from someplace other than you. At the UW Tacoma, plagiarism is a violation of the student conduct code and the consequences are serious. If you have questions about what amounts to plagiarism, seek guidance from faculty and the TLC.

○ Bias Reporting: Report an incident of bias or explore how to effectively respond by visiting <http://www.tacoma.uw.edu/reportbias>.

○ Safety Escorts are available Monday - Thursday 5:00pm - 10:30pm. Call the main office line at 253-692-4416. Additional safety information and emergency procedures is available at <http://www.tacoma.washington.edu/security>.

○ Campus Safety Information: <http://www.tacoma.uw.edu/campus-safety/home>. Safety escorts are available 24 hours a day, 7 days a week, there is no time limit. Call the main office line at 253-692-4416.

○ Inclement Weather: call 253-383-INFO or check the UW Tacoma homepage to determine whether campus operations have been suspended or delayed. If not, but driving conditions remain problematic, call the professor's office number. This number should provide information on whether a particular class will be held or not, and/or the status of pending assignments. If the first two numbers have been contacted and the student is still unable to determine whether a class(es) will be held, or the student has a part-time instructor who does not have an office phone or contact number, call the program office number for updated information.

○ Disability Support Services (Office of Student Success): the University of Washington Tacoma is committed to making physical facilities and instructional programs accessible to students with disabilities. Disability Support Services (DSS), located in MAT 354, functions as the focal point for coordination of services for students with disabilities. If you have a physical, emotional, or mental disability that "substantially limits one or more major life activities [including walking, seeing, hearing, speaking, breathing, learning and working]," and will require accommodation in this class, please contact DSS at (253)692-4508 , email at dssuwt@uw.edu or visit www.tacoma.uw.edu/drsuwt for assistance.

○ The Counseling Center (Office of Student Success) offers short-term, problem-focused counseling to UW Tacoma students who may feel overwhelmed by the responsibilities of college, work, family, and relationships. Counselors are available to help students cope with stresses and personal issues that may interfere with their ability to perform in school. The service is provided confidentially and without additional charge to currently enrolled undergraduate and graduate students. To schedule an appointment, please call 253-692-4522, email uwshaw@uw.edu , or stop by the Student Counseling Center (SCC), located in MAT 354. Additional information can also be found by visiting www.tacoma.uw.edu/counseling.

○ The UW Tacoma Library provides services and tools to support students at all levels of expertise. You can:

- check out books and videos,
- borrow technology, including laptops, graphing and scientific calculators, cables, phone chargers, headphones, and more,
- check out many required textbooks,
- book rooms for group study, and
- do 3D printing, and more.

Librarians help students become more confident about the research process, including developing paper topics, utilizing effective research strategies, and evaluating resources. Scheduled or drop-in help is available. Visit our website at www.tacoma.washington.edu/library or see us in person in the Snoqualmie (SNO) or Tioga Library Buildings (TLB).

○ Infants/Children in Class Policy: If you have no choice but to bring a child or children with you to class, please let me know prior to class. You will be responsible for seeing that the child or children are not disruptive to the class. If you are breastfeeding an infant or expressing milk regularly, you may bring an infant or breast pump to class. If you prefer to breastfeed or breast pump outside of class, you may take time out of class to use the lactation room (GWP 410).