

## Orientation/First Year Seminar 101-04 – Dr. Leonhardi -- Fall 2006

### The Mathematics of Games and Gambling

This is a University Studies course that satisfies the Unity and Diversity:Critical Analysis requirement. More details may be found at [http:// www.winona.edu/usp](http://www.winona.edu/usp).

Course Meets: Monday/Wednesday/Friday 1:00—1:50 PM, in Minne 241  
Instructor: Dr. Steve Leonhardi Phone: 457 - 2359 (can leave a message)  
Office: Gildemeister 203 E-mail: sleonhardi@winona.edu

Office Hours: Monday/Friday: 10:00-10:50 AM, 2:00-3:50 PM Wed: 8:00-10:50 AM  
 (tentative) Tuesday/Thursday: 9:30-9:50 AM (or by appointment)

Texts: Step By Step Guide To College Success, Jewler and Gardner, Thomson/Wadsworth  
The Mathematics of Games and Gambling, 2<sup>nd</sup> edition, Edward Packel, MAA  
 Additional readings and resources will be announced in class.

Course Description: Do you like to win at games? Why do casino gamblers and lottery ticket purchasers tend to lose more money than they win? We will mathematically analyze various strategies of play for both probabilistic games (those using dice, playing cards, casino games, state lotteries, etc.) and non-probabilistic games (those that depend only upon strategies chosen by the players). Students will also discuss readings and complete short assignments on the skills needed for college success, with special focus on critical thinking and problem-solving. We may also discuss the psychology of games and gambling, the ethics of gambling and lotteries, and applications of game theory to sports, social theory, politics, economics, and/or biology, as time allows and according to student interests. Students should start the course with competence in high school algebra and a willingness to learn some basic probability theory.

Class Attendance: Required. Accomplishing the objectives of this course requires that you be present and part of the discussion each week. You are responsible for knowing what is covered and assigned in class regardless of whether or not you are present. Please contact me, before class unless in case of emergency, if you must miss a class for any reason.

Homework Assignments: You will be assigned a number of Orientation Homework assignments, as well as Mathematical Homework and Quizzes. These will serve the two goals of making your transition to college more successful, and helping you to learn to mathematically analyze games and gambling. Late homework will receive half credit if turned in by the next class period and before solutions are given.

Activity and Event Reports: You must attend at least four student activities or campus events during the semester and write a half-page report/reflection on each, following the guidelines given on a later page of this syllabus. Please contact me to check whether an event qualifies, and obtain a copy of a program or take notes if at all possible and appropriate.

Midterm Exam and Final Exam: These will be based on the mathematical content of the course. No early or late exams will be given, except at my discretion and under unusual circumstances.

Grading: 90% is sufficient for an A; 80% for a B; 70% for a C; 60% for a D grade.

Attendance (40 classes @ 2 pts per class):	80 points
Orientation Homework (approx. 8 @ 10 pts each, scaled as needed):	80 points
Activity and Event Reports (4 reports @ 10 pts per report):	40 points
Math HW/Quizzes (approx. 10 @ 20 points each, scaled as needed):	200 points
Exams (Midterm and Final exam, @ 100 points each):	200 points
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**Total: 600 points**

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### Orientation Topics:

- Goals and expectations. How is college different from high school?
- Keys to success in college.
- Campus resources.
- Interacting with professors.
- Student activities.
- Time management and money management.
- Note-taking, study skills, and test-taking.
- Problem-solving and group work.
- Critical thinking. Citizenship as a student.
- Getting along with roommates.
- Cultural diversity.
- Personal health and wellness.
- Career information. Choosing a major.
- University Studies requirements and major program tracks.
- Advising and registration.

### Mathematics of Games and Gambling Topics:

- Why do people play games? The phenomenon of gambling.
- Finite probabilities and odds. Dice, cards, and roulette.
- Computational rules: complement, addition, multiplication rules.
- Mathematical expectation. The St. Petersburg paradox.
  
- Investor temperaments: risk and reward. The psychology of gambling.
- Backgammon (depending upon student interest).
- Craps and Chuck-A-Luck.
- Permutations and combinations.
- Counting poker hands.
- Betting in poker.
- Bridge distributions (depending upon student interest).
- Keno/Bingo type games.
  
- Lotteries and expectation.
- The ethics of gambling and lotteries.
  
- Repeated trials. The Binomial distribution.
- Betting systems. The Gambler's Ruin problem.
- Blackjack (depending upon student interest).
  
- Randomness. Are the winners skillful or lucky?
- Sucker bets: expected waiting time.
- Paradoxes and problems with ranking systems (devious dice).
  
- Types of games: probabilistic, strategic, and combinatorial.
- Combinatorial games: Nim, squares, chess.
- Strategic games: prisoner's dilemma, chicken. Zero sum games and non-zero sum games.

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### **Activity and Event Reports**

The purpose of this required component of the Orientation course is to encourage you to attend and participate in campus activities, events, clubs, and organizations.

Examples of “qualifying activities” would be:

- a club, organization, or society meeting
- an artistic event: a musical concert, theatrical presentation, poetry reading, etc.
- an academic talk: campus Lyceum, guest speaker, departmental colloquium, etc.
- a sports event, playing (intramurals or intermurals) or watching (intermurals)

You may use the same type of club or activity more than once.

Please ask me if you are not sure whether a certain activity or event qualifies.

How can you find out about such activities?

- <http://www.winona.edu/admissions/clubs.htm>
- <http://www.winona.edu/calendar/calendar.asp>
- posters in “The Hyphen” in Kryzsko Commons, and on other bulletin boards around campus

You must attend at least four (4) such events during the semester and write a report/reflection for each event. The due dates are as follows:

First report due by:	Wednesday, September 13 <sup>th</sup>
Second report due by:	Wednesday, October 4 <sup>th</sup>
Third report due by:	Wednesday, October 25 <sup>th</sup>
Fourth report due by:	Wednesday, November 15 <sup>th</sup>

I encourage you to complete and turn in these reports well before the deadlines.

Each report should be one-half to one page (no more than two pages), and should be written in complete sentences. Your report should address the following questions:

- Name, date, time, and location of the activity or event.
- What happened at the event?
- What was your reaction? Did you enjoy it? Are you glad you went?
- Would you like to participate in this type of event again?
- Give the name of one other person who was there and whom you talked with at the event. Did you meet someone new as a result of participating?
- Did you learn something about yourself as a result of participating?

Please include, with your report, a copy of a program (e.g., for a concert or play), and take notes during or shortly after the event, if at all possible and appropriate.

Each report will be worth a maximum of 10 points, graded according to the following scale: 10=Excellent, 8=Good, 6=Adequate, 4=Inadequate, 2=Completely Inadequate.

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**Resources for Studying the Mathematics of Games and Gambling**

The following books are on two-day reserve at the front desk of the Winona State library.

The Mathematics of Games and Gambling, 2<sup>nd</sup> edition, Edward Packel, Mathematical Association of America, 2006. This textbook is required for the course, so you should each have a copy. The first (1981) edition is on reserve at the library [QA 271 .P3], but you should have a copy of the second edition, which contains additional topics.

Luck, Logic, & White Lies: The Mathematics of Games, Jorg Bewersdorff, translated by David Kramer, AK Peters, 2005. [QA 269 .B39413 2004] This is a very comprehensive volume of analysis of a wide variety of games, and would have also served as a good text for this course. The preface, which classifies games into different types, is especially good.

The Mathematics of Games, John Beasley, Oxford University Press, 1990. [QA 269 .B33 1980] This book analyzes an eclectic mix of games, including snakes and ladders, cyclic expectations, and Nim. Good balance of readability and mathematical details, but less complete than the above books.

The remaining books are intended for a more general audience and are therefore easier to read, but less complete than the above books, omitting some of the mathematical details. They are listed in order from most mathematical to least mathematical.

Chance Rules: An Informal Guide to Probability, Risk, and Statistics, Brian S. Everitt, Springer-Verlag, 1999. [QA 273 .E84]

Taking Chances: Winning With Probability, John Haigh, Oxford, 2003 (new edition), [].

What Are the Odds: Chance in Everyday Life, Mike Orkin, Owl Books/Henry Holt, 2000. [QA 273.15 .O75 2000]

Chances Are: Adventures in Probability, Michael Kaplan and Ellen Kaplan, Viking/Penguin, 2006. []