

Common Course Outline
MATH 128 (or other 100 level)
Mathematics and Strategy of Gaming
3 Semester Hours

The Community College of Baltimore County

Description

Students will study probability theory and its application to gaming. Covers permutations and combinations, laws of probability, expected value, trees, gambler's ruin, binomial and multinomial distributions, goodness of fit, elementary game theory, and social issues. Applications include casino games, lotteries, racing, wagering systems, business and investment decisions, conflict and competition. Prerequisites: Math 083 or Math 101 or LVM3 or sufficient math placement score LVR2 and LVE2.

Overall Course Objectives

Upon completion of this course the student will:

1. Be able to apply the Fundamental Principle of Counting, Combinations, Permutations, and variations of these forms of counting to determine the number of outcomes in a chance experiment.
2. Be able to define and use the vocabulary of probability and game theory, and use the terminology to correctly classify a chance experiment.
3. Calculate probabilities using the Addition Rule, the Product Rule, the Negation Rule, as well as combinations of these rules and more advanced techniques.
4. Be able to use technology, both graphing calculator and computer, to compute probabilities and run simulations.
5. Be able to construct a tree diagram for multi-step chance experiments, and use the tree to count outcomes and compute probabilities.
6. Be able to calculate the expected value of a wager, and interpret its meaning.
7. Describe and discuss the business of gaming, earned income and profit, and estimate over a large number of plays the income earned from casino games, the lottery, and others.
8. Discuss Gambler's Ruin theory and apply its formulas to analyze games and determine the best strategies of play.
9. Apply the theory discussed in this course to the analysis of casino games, the lottery and its variations, the racetrack, pools, and to gambling systems.
10. Discuss gaming in other cultures, as well as the business of gaming in those cultures, and apply probability theory to the analysis of those games.
11. Utilize statistical procedures to determine if a game or a piece of gaming equipment is fair and unbiased, and discuss how a casino, lottery, or other form of gaming business maintains this fairness.

12. Utilize the internet to search for and verify solutions to games of chance, and to search for articles discussing games and strategies.

Major Topics

1. Overview of Gaming.
 - a. In the United States.
 - b. In other countries.
2. Counting.
 - a. The Fundamental Principle of Counting.
 - b. Permutations.
 - c. Combinations, binomial and multinomial.
3. Basic concepts and Terminology.
 - a. Sample space
 - b. Simple and compound events; dependent and independent events; complementary events; well defined and ambiguous events.
 - c. Definition of probability, and basic assumptions.
 - d. Classical, Relative Frequency, and Subjective probabilities.
 - e. Odds and their relationship to probability.
 - f. Volatility and expected sequences of outcomes.
4. Probability Rules.
 - a. The Addition Rule and mutually exclusive events.
 - b. Compound probabilities and the Product Rule.
 - c. The Negation Rule.
 - d. Combinations of these rules.
5. Applications.
 - a. Casino games and the lottery.
 - b. Sports and the Racetrack
 - c. Betting Systems.
6. Tree Diagrams.
 - a. Enumerate the outcomes for a chance experiment.
 - b. List the probabilities of each outcome.
 - c. Use the tree to compute probabilities of various events.
7. Expected Value.
 - a. Use a table for computations and display.
 - b. Applications and interpretations.
8. Gaming as Business.
 - a. Long term versus short term play.
 - b. Casino, etc: keeping games fair, and profit (option: invited speaker)
9. Gambler's Ruin.
 - a. Formulas.
 - b. Strategies and best play.
10. Use of technology in the analysis of games.
 - a. Computer and the Graphing calculator.
 - b. The Internet.
11. Distributions.
 - a. Binomial and multinomial distributions.
 - b. Goodness of fit tests.

12. Introduction to Game Theory.
 - a. Zero-sum and non zero-sum games.
 - b. Two-person games and the Prisoner's Dilemma
 - c. Strategies.
13. Social and Historical issues.
 - a. History of gaming.
 - b. Addictions and social impact (option: invited speaker)
14. Games in other cultures.
 - a. The business of gaming in other cultures.
 - b. Social considerations.

Course Requirements

Grading/exams: Grading procedures will be determined by the individual faculty member but will include the following:

1. Two (2) examinations.
2. One (1) project. Suggestions are
 - a. Students in small groups will play a casino or other game. A complete mathematical analysis of the game will be submitted.
 - b. Students in small groups will play a casino or other game with equipment (For example, a roulette wheel, dice, or a lottery machine) repeated times in order to gather data. Use the data to perform a Goodness of Fit test to determine if the data indicate the equipment is fair or biased.
3. Quizzes and/or home assignments.
4. Final exam; or a research paper on a game or games of chance (US or other culture; in either case with instructor's approval) dealing with the history, mathematics, business, etc. of gaming.

Students are expected to attend all class sessions. Students are responsible for any work missed due to absence. Students with excessive absences (20% or more) will not pass the class. Students are expected to complete all home assignments.

Writing: The individual faculty member will determine specific writing assignments.

Other Course Information

This is a general education course. Its prerequisite is Math 083 or the consent of the instructor. This course will use technology for calculations and analysis.

Individual faculty members may include additional course objectives, topics, or other course requirements in addition to the minimum expectations stated in the Common Course Outline.

The Community College of Baltimore County (“CCBC”) is committed to providing a high-quality learning experience that results in growth in knowledge, attitudes, and skills necessary to function successfully as a transfer student, in a career, and as a citizen. To accomplish this goal, we maintain high academic standards and expect students to accept responsibility for assignments, participate actively in class activities and prepare accordingly for all forms of assessment.

CCBC takes seriously our responsibility to maintain high-quality programs and will periodically ask the instructors to participate in various assessment activities to determine whether our students are attaining the knowledge, attitudes, and skills appropriate to various courses and programs. The assessment activities may take many different forms such as surveys, standardized or faculty-developed tests, discussion groups, or portfolio evaluations. We ask that the instructor take these activities seriously so that we can obtain valid data to use for the continuous improvements of CCBC’s courses and programs of study.

Date Revised: 10.10.06
Updated: 03.05.07