

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): MATH 1670 RECREATIONAL MATHEMATICS (3,3,0)

Course Aims: This course aims to introduce the excitement of tackling various games and puzzles using elementary yet powerful mathematical concepts such as mathematical induction, parity, pigeon-hole principle, recursive relation, etc. The approach is problem-based, and the prerequisite of mathematics is minimal: all that's required is a curious mind and a healthy appetite to engage in logical excursion. Upon completion of this course, students will gain an appreciation of the power and practicality of mathematical thinking, and in particular will learn how to dissect games of varied structures and formats in order to develop winning strategies.

Prerequisite: CE Math

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Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to understand the concepts of mathematical induction
2	Able to understand the concepts of pigeon-hole principle
3	Able to understand the concept of game theory
4	Able to understand the basic concepts of probability theory, statistics and decision theory
	Skill
5	Able to apply pigeon-hole principle to some problems in geometry, counting puzzles, card puzzles, magic tricks based on numbers, etc
6	Able to apply mathematical induction to chessboard puzzles, tower of Hanoi and HEX, etc
7	Able to apply game theory to solve two person games and develop winning strategies, such as NIM
8	Able to apply decision theory to identify the best decision in various games
	Attitude
9	Able to work effectively in a team
10	Able to solve problem independently
11	Able to appreciate the diversity of the applications of elementary yet powerful mathematical concepts on various real-life problems

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Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment (assignments and mini-project)	40%	Continuous Assessment and mini-project are designed to measure how well the students have learned the elementary yet powerful mathematical concepts and their applications. The team-project is designed to stimulate students' interest in furthering understanding and analyzing practical problems in real life situations.
2	Final Examination	60%	Final Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be analysis and skills based to assess the student's versatility in solving various real-life problems using elementary mathematical concepts and dissecting games of varied structures and formats in order to develop winning strategies.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Introduction	1,2	6
II. Assorted Puzzles	5,6,9-11	10
III. Solitaire Games	5,6,9-11	10
IV. Two-person Games	3,4, 7-11	12

References: B. Averbach and O. Chein, Problem Solving Through Recreational Mathematics, Dover, 1999.
M. Gardner, My Best Mathematical and Logic Puzzles, Dover, 1994.

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Course Content in Outline:

<u>Topic</u>	<u>Hours</u>
I. Introduction	6
A. Sample games	
B. Modular arithmetic	
C. Mathematical induction	
D. Parity principle & pigeon-hole principle	
II. Assorted Puzzles	10
A. Magic tricks based on numbers	
B. Chessboard puzzles	
C. Counting puzzles	
D. Word puzzles	
III. Solitaire Games	10
A. Solitaire	
B. Tower of Hanoi	
C. Lloyd's fifteen-puzzle	
IV. Two-person Games	12
A. Examples of games including NIM	
B. Payoff matrix	
C. Dominance principle	
D. Winning strategies	

