

Inductive and Deductive Reasoning Final Syllabus

		WHAT (skills, goals, knowledge, concepts, readings)	HOW (activities)
Day 1	Morning	Class Introductions	Intro logic problem involving student's names and seating arrangement. Have students come up with class rules Opening word games and other logic puzzles
	Afternoon	1. Introduction to Inductive and Deductive 2. Ind and Ded. Arguments 3. Counter Examples	1. Question students as to their prior knowledge of the subject. Small lecture on difference between Inductive and Deductive reasoning 2. Completed worksheet and discussed answers. 3. Discuss universal claims and counterexamples. Completed "Finding Counter Examples" worksheet. Discussed Answers
	Late Afternoon	Chapter 1 & 2 of <i>Number Devil</i> (ND)	Read and Discuss
Day 2	Morning	1. Warm Up Puzzles 2. "If—Then" Statements	1. Puzzles led by Inst, TA, or students. 2. Complete "On Patrol" group activity to get intuitive ideas about "if, then" statements. Introduce truth tables and relate back to activity. Complete "Conditional Statements" worksheet.
	Afternoon	1. Warm Up Puzzles 2. Implications & Relatives 3. Other Truth Tables and connectives	1. Led by Inst. TA, or students 2. Introduce inverse, converse, contra positive, and negation. Have students complete truth tables to determine which statements are equivalent. 3. Introduced other connectives like negation, and, or, biconditional. Gave many examples of simple statements. Completed worksheet on "Rules of Equivalence"
	Late Afternoon	1. Chapter 3 ND 2. Logic Problems	1. Read and discuss topics covered 2. Worked in pairs on questions from <i>Crossing the River with Dogs (CRWD)</i> textbook. Solve problems with matrices.

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Day 3	Morning	<ol style="list-style-type: none"> 1. Warm Up Puzzles 2. Review Day 2 material 3. Continuation of truth tables—determining truth values 	<ol style="list-style-type: none"> 1. Led by Inst., TA, or students 2. Translate given problems from symbols to words. Find truth-value of translated statements. 3. Work individually or with a partner to complete Part II and III on “Truth Value” WS.
	Afternoon	<ol style="list-style-type: none"> 1. Continuation of truth tables 2. Syllogisms 3. Group Logic Problems 	<ol style="list-style-type: none"> 1. Same as above 2. Lecture about proper form and purpose of syllogisms. Make own syllogism. Complete “Valid, Invalid” Worksheet. Discuss answers and student ideas. 3. In groups of 4. Give 4-6 cards with information. Must complete the Logic Problem. Problems: Small Block “B” and Grups, Dwarts, Teasles.
	Late Afternoon	<ol style="list-style-type: none"> 1. Chapter 4 ND 2. Valid, Sound, Good 	<ol style="list-style-type: none"> 1. Read and Discuss topics 2. Review meaning of validity. Explain Sound and Good. Do a few examples as a class and then complete the worksheet. Discuss final answers.
Day 4	Morning	<ol style="list-style-type: none"> 1. Warm Up Problems 2. Circle Logic 3. Venn Diagrams 	<ol style="list-style-type: none"> 1. Led by Inst., TA, or students 2. Class discussion of Circle Logic and how to categorize people or things, depending on the argument. Complete worksheet on Circle Logic (pg. 66,68) 3. Review Grups, Dwarts, Teasles problem and how it relates to Venn Diagrams. Determine student’s prior knowledge. Lecture or review Venn Diagrams and their effectiveness. Complete various worksheets that are related to the subject.
	Afternoon	<ol style="list-style-type: none"> 1. Finish Venn Diagrams 2. Intro to Sequences 	<ol style="list-style-type: none"> 1. Complete worksheets and present selected solutions. Check students understanding of Venn Diagrams. 2. Present Handshake Problem and “Knights of the Round Table” problem. (Both involve patterns). Lead students through examples and allow time for individual, pair, or group investigation.

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	Late Afternoon	1. Chapter 5 ND 2. Individual work time	1. Read and discuss topics. 2. Students work on previous worksheets or problems, logic puzzles, etc.
Day 5	Morning	1. Warm Up puzzles 2. Sequences: Arithmetic, Geometric, Figurate, etc	1. Led by Inst., TA, or students 2. Give the class an example of 3-4 sequences, and ask them what they have in common. Look into the differences between the types. Complete basic sequences on worksheet
	Afternoon	1. Sequences (con't) 2. Conference with students.	1. Determine how to create formulas for given sequences. Find the Nth term and apply formula, as needed. 2. Individual Conferences
	Late Afternoon	1. PI Day (Collaboration with History of Math)	1. Investigate relationship between diameter, radius, circumference, area. Use circular objects and food to find this relationship.
Day 6	Morning	1. Finish up Pie Day 2. Review of Sequences 3. Fibonacci Numbers in Nature	1. Give historical background and present information about PI. 2. Ask students to name and describe the different types of sequences and how we can generalize a rule for each type 3. Intro to Fib. Numbers. Assess student's prior knowledge. Look at patterns in nature on overheads.
	Afternoon	1. Pascal's Triangles 2. Locker Problem—pattern	1. Fill in Pascal's Triangle. Look for patterns. Color Pascal's triangle. Discuss patterns and display student work. 2. Introduce locker problem with students as the lockers. Then have them solve the problem
	Late Afternoon	1. ND Chapter 6 2. 5-Minute Mystery 3. Individual Work Time	1. Read and discuss 2. Read mystery to students and have them come up with solutions using deductive reasoning and analysis 3. Students work, as needed.
Day 7	Morning	1. Warm up puzzles 2. Logic Puzzles and Hat Problem 3. Computer Lab—Pascal and Tower of Hanoi	1. Led by Inst., TA, or students 2. Introduction to Logic Problems. Solve and prepare to create own puzzle. 3. Use computer to look into Coloring patters on Pascal's Triangle and Tower

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			of Hanoi. Find pattern to describe number of moves necessary to solve Tower of Hanoi problem.
	Afternoon	<ol style="list-style-type: none"> 1. Warm up puzzles 2. Group Work—Pattern Problems 3. Magic Squares/ Stars /Hexagons 4. Hat Problem (revisited) 	<ol style="list-style-type: none"> 1. Led by Inst, TA, or students 2. Complete Pattern problem with clues in groups. Present solutions to the class 3. Create Magic Squares and other shapes. Will discuss on Day #8 4. Discuss possible solutions to the Hat Problem.
	Late Afternoon	<ol style="list-style-type: none"> 1. ND Chapter 7 2. Logic Puzzle (Dee and Dum) 	<ol style="list-style-type: none"> 1. Read and discuss. 2. Students work on puzzles with partners to determine truth-values.
Day 8	Morning	<ol style="list-style-type: none"> 1. Warm up puzzles 2. Review Magic Squares and Logic Puzzles 3. Intro to Algebraic Properties 	<ol style="list-style-type: none"> 1. Led by Inst, TA or students 2. Discuss answers and techniques of previous day's material—Magic Squares and Logic Puzzle. 3. Give them Algebraic properties that are used in formal proof. Introduce distributive property and variables.
	Afternoon	Number Theory Proofs	Introduce number theory proofs. Explain how inductive patterns can become deductive proofs. Do one proof with the students. Students complete others individually or with a partner. Ex. $Odd * odd = odd$ or $even * even = even$
	Late Afternoon	<ol style="list-style-type: none"> 1. ND Chapt 8 2. Finish Number Proofs 	<ol style="list-style-type: none"> 1. Read and discuss 2. Give students time to do finish proofs. Collect student's proofs for evaluation.
Day 9	Morning	<ol style="list-style-type: none"> 1. Return student work 2. Review Number Theory Proofs 3. Greek Alphabet 4. Interesting Fallacies 5. Proof by contradiction 	<ol style="list-style-type: none"> 1. Return student work from previous day. 2. Have students put all proofs on the board and present their solutions. 3. Present greek alphabet. 4. Present $2=1$ Fallacy 5. Introduce by doing a maze backwards. Complete two proofs as a class: if n times n is odd, then n is odd and the square root of 2 is irrational. Explain why it is so useful and how it relates to truth tables (TF combination).

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	Afternoon	1. Venn Diagrams 2. Math Induction	1. Complete <i>Crossing the River with Dogs</i> worksheet by using Venn diagrams to solve the problems. 2. Introduce the idea of Math Induction as a valid, deductive proof through a helicopter analogy.
	Late Afternoon	1. ND Chapt. 9 2. Math Induction, con't	1. Read and discuss 2. Show induction using numerical statement. Complete one problem as a class. Discuss method
Day 10	Morning	1. Leap Frog Problem 2. Logic Problems	1. Put students in groups of 6 and have them solve a variety of problems through trial and error by actively participating as frogs. 2. Introduce a variety of logic problems that could help them create their own. Problems involve pennies, cards, etc.
	Afternoon	1. Harry Potter Mystery 2. Create Logic Problem	1. Present students with logic puzzle from <i>Harry Potter and the Sorcerer's Stone</i> . Have them work as a table to solve the problem and justify their solutions. 2. Let students create their own logic problems individually or with a partner. Required elements: Intro story, matrix, clues, key.
	Late Afternoon	Class collaboration with History of Math and Data and Chance classes	Do "Usual Day at Unusual School" and "Ice Cream Stands of Iceberg" problems in a group of 3. One student from each class will be randomly put into groups. Correct answers receive prizes.
Day 11	Morning	1. Finish Logic Problems 2. Seating Chart Logic Problem	1. Students are given time to finish creating their logic problems. 2. Students change seats according to logic problem, created by TA. Help facilitate discussion, but allow students to solve it on their own. If time is limited, lead the class to the solution.
	Afternoon	Euler Path and Circuits	Introduce Euler paths and circuits through pencil paths (do not lift your pencil, but complete the shape). Present solutions on the board, look for

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			conjectures. Give lecture, information about circuits and paths. Have students apply knowledge and rules to a worksheet. Also, create own house plan or neighborhood that is a path or circuit. Display student work on the wall.
	Late Afternoon	1. Read Chapt. 10 ND 2. Individual/Group work time	1. Read and discuss 2. Give students time to finish logic puzzles and Euler creations.
Day 12	Morning	1. Warm-up activities 2. Mobius Strips	1. Led by Inst., TA, or students 2. With construction paper, create Mobius strips. Cut figures in half and thirds and discuss findings. Lead class through more detailed configurations evolving 2 or more Mobius strips. Ask for conjectures and then identify shapes.
	Afternoon	1. Finish Mobius Strips 2. 4-color theorem	1. Discuss historical background of the Mobius strip and its created. 2. Have students color a variety of maps using only as many colors as necessary. Have them conclude that only 4 colors are needed for any map. Discuss historical information about the theorem and why it took so many years to prove.
	Late Afternoon	1. ND Chapt. 11 2. Wrap up collaboration time from Day 10	1. Read and discuss. 2. Give the groups of students enough time to finish their problems. Announce winners. Instructors and TA's facilitate group work. Have groups of students who get done early help other groups arrive at a solution.
Day 13	Morning	1. Individual Work Time 2. Intro to Probability	1. Let students work on worksheets or puzzles of their choice. Emphasis problem solving and critical thinking skills. 2. Play basis probability games with initial analysis of possible strategies. Introduce definitions and notes about probability and related terms.
	Afternoon	1. Probability practice 2. Matrix problems	1. Have students complete worksheet on basis probabilities. When students finish, they can work on a worksheet related to darts and probabilities.

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			Discuss solutions to basic probability worksheet. 2. Students will type the logic problem that they created. If time permits, a book will be created of all of their problems.
	Late Afternoon	1. Probability games and analysis 2. Color Induction game	1. Students play probability games and then compute the expected value of the dice game. The expected value is then used to create a strategy. Discuss whether that strategy will or will not work. 2. On a 5x5 matrix with 5 colors, students deductively determine the configuration of the colors.
Day 14	Morning	Preparation for final day	Students complete course evaluations, sign up for final conference time, and go over final day schedule.
	Afternoon	Individual work time	Student work in pairs or individually on worksheets or other puzzles. Students pick the worksheet that they are most interested in (all relate to problem solving or logical thinking skills).
	Late Afternoon	Read final chapter of the <i>Number Devil</i> .	Read and discuss overall impression of the book and the mathematicians that were introduced. Allow time to answer student questions about concepts that were mentioned in the book, but not explained in great detail.
Day 15	All Day	1. Student created games 2. Clean-up, Wrap Up, Prepare for Parents	1. Play games and puzzles created by Data and Chance class. 2. Clean-up, Wrap-up, prepare for parents.