

Mathematical Modeling CTY

Book: For All Practical Purposes 6th edition 2003, COMAP INC., W H Freeman

DAY	TIME	TOPIC	ACTIVITY
Day 1	Morning	Introductions Rules & Regulations (Honor Code, cheating, plagiarism, no taking books out of class) Introduction into Euler Circuits	State your name & a math term that goes with your name (i.e. Binary Becky) Human knot Sprouts – Is the games outcome predetermined?
	Afternoon	Euler Circuits	Discussion Problems: 7 bridges of Koingsburg Walking Patrolman
	Evening	Pretest Review circuits, practice problems	*Page 205 (15, 17, 18, 23, 26, 31, 41, 55, 56, 66, 67) <i>Excursions in Modern Mathematics</i>
Day 2	Morning	Hamiltonian Circuits	Traveling Salesman Story Hamilton vs. Euler discussion A Tale of 5 Cities
	Afternoon	Hamilton Circuits Present Graphs & best Paths	Make a graph of the campus. Is the map a Hamilton circuit? Pretend you are a tour guide and you want to show potential students the site without passing any site twice? What path would you make?
	Evening	Hamilton Circuits	Page 61 (1, 4-6, 8, 9, 12, 15, 16, 27, 29, 30, 34, 36-38, 40, 41, 43, 51, 53, 56) <i>For All Practical Purposes</i>
Day 3	Morning	Voting Methods <ul style="list-style-type: none"> • Arrow's Impossibility Theorem • Plurality Method • Majority Rule • Condorcet Criterion • Borda Count Method • Plurality with Elimination • Pairwise Comparisons 	Read the article, "How to Fix an Election" Discussion of positives and pitfalls of each voting system Complete the "Will the Best Candidate Win?" Vote on a class Mascot Vote on a name for the mascot

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	Afternoon	Weighted Voting Systems <ul style="list-style-type: none"> • Shapley-Shubik Power Index • Banzhaf Power Index 	Journal Entry. You are trying to set up an election. Why are you having an election? Which voting method are going to choose and why?
	Evening	Electoral College	Read article and discuss how the electoral college is an example of a weighted voting system
Day 4	Morning	Weighted Voting	Team up with other Math Modeling and play “Coalitions”
	Afternoon	Apportionment Methods: <ul style="list-style-type: none"> • Hamilton • Jefferson • Adams • Webster • Hill 	Split class into four groups. Each group reads and does an example of one of the first four methods and then presents it to the class. Example: <i>Conventional Method's don't Always Work</i> Each person does the first four methods using the example Hand out a list of the apportionment of the electoral college for the 200 election. Who won? Bush or Gore?
	Evening	Book work	Finish Coalitions & page 537 (1, 3-5, 10-12, 21, 22, 24, 34b,c, 36)
Day 5	Morning	Fair Division <ul style="list-style-type: none"> • Sealed Bids • Estate Auction • Method of Markers • Divisor/Chooser 	Sealed Bids: Auction off a 10 piece poker chip. Auction off a sealed brown bag Have an estate auction with a car and picture and house. Method of Markers: Lay out candy. Divide class into four groups and play out a method of markers with candy.
	Afternoon	Fair Division <ul style="list-style-type: none"> • Lone Divider Method • Last Diminisher 	Cut a cake using the last-diminisher method.
	Evening	Book work	
Day 6	Morning	Statistics <ul style="list-style-type: none"> - Thematic Maps - Comparing statistical data 	Census Bureau – lesson plan – computer lab http://www.census.gov/dmd/www/pdf/912ch2.pdf Computer Lab: www.census.gov http://www.ncgia.ucsb.edu/projects/Cartogram_Central/ What is a cartogram? http://www-personak.umich.edu/~mejncartograms/

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	Afternoon	Statistics -mean, median, mode (Measures of central tendency) - graphs (Calculator) - Box Plots - Frequency Tables -Stem & Leaf Plots	Give each student a bag of M&M's. Have them write a frequency chart, and create a Stem & Leaf plot with the data collected from there M&M's. Then bring the class together, make a full frequency chart, bar graph, histogram, and Box & Whisker Plot.
	Evening	Book work	
Day 7	Morning	Tree Diagram Probability	Coin toss – Break students into pairs, toss coin 100 times. Combine with table. Combine class data. (During break, compile other data.) Computer lab – Monty Hall
	Afternoon	Probability	Tournament with evens/odds - probability of winning Raffle
	Evening	Probability	Yatzee Find the probability of different card hands.
Day 8	Morning	Midterm	
	Afternoon	Binary Modular Arithmetic	Add, subtract, Multiply & Divide Binary Binary Bingo
	Evening	Post Net Code Cryptology Encoding using Matrices	Hand out letters and decode zip code. Come up with your own matrix. Encode your message. Then pass your paper around and that person will find the decoding message.
Day 9	Morning	Caesar Cipher	Computer Lab: Create Caesar's cipher using Excel Calculators: Create ciphers using matrices
	Afternoon	Fibonacci Numbers	Tell story about the Rabbits. Give some background information on Leonardo "Fibonacci" Wrote Fibonacci numbers around the room on the top of the chalk boards. Make golden rectangle using our bodies on white paper.
	Evening	Golden Ratio	Construct golden rectangle. Measure different parts of the body to see if it correlates to the golden ratio.
Day 10	Morning	Map Coloring	Color graph in 4 different shades without ever touching any other property.
	Afternoon	Infinity Infinite Hotel Cantor Set	Discussion Infinite Hotel: PowerPoint
	Evening	Review/Read ahead on Fractals	Apportionment problems Read chapter on Fractals (From different book) Start cutting out 3-D Sierpensi Triangle

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Day 11	Morning	Fractals Sierpinski Triangle Kosh Snowflake	Make a Koch Snowflake On poasterboard have each student make a Sierpenski Triangle, Sierpenski Carpet, or Koch Snowflake Continue making three dimensional Sierpinski Triangle
	Afternoon	Fractals Continued Madelbrot Sequence	Sequences Complex Numbers (What are they? How do you multiply them?) Mandelbrot Set Computer Lab – 1 st hour http://www.lightlink.com/homer/what.html http://www.coolmath.com/fractals/fractals_lesson.html Fractal Fern
	Evening	Fractals Continued	Finish Mandelbrot Set Show pictures Finish up poster board and continue cutting out pieces for Sierpenski Triangle
Day 12	Morning	Transformations: Translations • Frieze Patterns Symmetry • Reflectional/Line Rotational	Students create there own Frieze Patterns Freize patterns, tessellations, tilings, with regular polygons
	Afternoon	Tessellations	Tangram Race Cut out different regular polygons. Will they tessellate? Which polygons tessellate? Will certain combinations be able to tessellate?
	Evening	Penrose Tiling	What is tiling? What is the difference between Periodic and nonperiodic? Have students look at six examples and decide if the tessellations are periodic? What is Penrose tiling. Break students into pairs, giving each of them enough Penrose tiles to form all 7 arrangements. Have them discover the 7 arrangements on their own.
Day 13	Morning	Penrose Tiling	Project: Create your own Penrose Tiling on poster board
	Afternoon	Posttest	Posttest
	Evening	Polyhedra/Platonic Solids	Computer Lab 1hour
Day 14	Morning	Project Present projects for anyone leaving early	Put students into groups of 3 – each group picks one platonic solid and creates a net, origami, interesting facts. Where is it used in life?
	Afternoon	A look at proofs	Read an article Watch: <i>The Proof</i> with the other Math Modeling class

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Day 15	Morning	Present Platonic Solids Projects Pictures & Goodbyes	

If Time:

Billiards – Calculating angles	Play billiards using calculations http://www.geocities.com/CapeCanaveral/Lab/8972/lessons/pool_howto.html
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