National Paralegal College

717 E Maryland Ave
Phoenix, AZ 85014-1561
Tel: 800 - 371 - 6105
Fax: 866-347-2744
e-mail: info@nationalparalegal.edu

MAT-201-1302

Ideas in Mathematics

Syllabus and Course Guide

The NPC Ideas in Mathematics class meets 15 times over the course of the 8-week term in the NPC Interactive classroom. Each session consists of about 60 minutes of online lecture by the course instructor. After the lecture, students may ask questions and make comments on the material being studied.

Unless otherwise noted, all classes will take place at 7:00 PM Eastern Time.

To successfully complete the course, each student must satisfactorily complete:
- 5 written assignments
- 3 examinations

INSTRUCTORS:

The instructors for this course are:
Lecturer:
– Yael Katz (npcmath@gmail.com)

Teacher's Assistant/ Grader:
- Steven Rosenberg (e-mail to be posted to the course message board)

COURSE DESCRIPTION:

What is the best route to take to the airport? What is the best way to elect the president? How can we sustain a renewable resource? These are just some of the questions that we will explore in this introductory mathematics course for the non-major.

In fifteen lectures we will develop six topics in depth, chosen for their importance, timeliness and accessibility. Emphasis will be placed on understanding the problems and their applications to the real world as well as problem-solving approaches, including

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computational methods. The course starts out slowly to help students gain confidence, and critical-thinking skills are carefully developed throughout.

COURSE OBJECTIVES:

Mathematical models underlie decisions in science, industry, economics, and business, and using mathematics to solve problems can improve our lives. The primary goal of this course is mathematical literacy – for the student to understand how mathematics is used in the world around us. The student will gain this broad understanding of contemporary mathematics through the study of the following specific topics:

- Graph Theory: finding the optimal method to solve a problem
- Statistics: how to analyze and manipulate data
- Voting Systems: fairness and social choice
- Game Theory: conflict strategies
- Dynamical Systems and Chaos: biological populations and sustaining resources

READING ASSIGNMENTS:

All reading assignments refer to the following textbook:

COMAP (the Consortium for Mathematics and Its Application), *For All Practical Purposes: Mathematical Literacy in Today's World*

- **ISBN-10:** 1429243163
- **ISBN-13:** 978-1429243162

The textbook may be obtained from any source you choose, including but not limited to:

Direct from the Publisher:

http://www.whfreeman.com/Catalog/product/forallpracticalpurposes-ninthedition-comap

Amazon.com

http://www.amazon.com/All-Practical-Purposes-Mathematical-Literacy/dp/1429243163

Textbooks.com:

http://www.textbooks.com/For-All-Practical-Purposes-Cloth-9th-Edition/9781429243162/Comap.php

WRITTEN ASSIGNMENTS:

During the course as indicated on this syllabus, five assignments will be posted "assignments and documents" page. The 5 assignments will cumulatively count for 40% of the student's grade for the course. Information will be posted to the message board that indicates when the material for each assignment is discussed in class.

Assignments are to be submitted via the section of the student menu entitled "Assignments and Exams."

Each submitted assignment will be graded on the following scale:
4 - Excellent
3 - Good
2 – Satisfactory
1 – Poor
0 – Not acceptable (must resubmit)
(Half-points may also be awarded in assignment grading.)

It is highly recommended that assignment answers be composed in a word processing program and then pasted into the NPC system rather than composing it in the assignment answer window. This is important because an inadvertent page refresh or login timeout could cause you to lose all unsaved work typed into the NPC assignment window.

PDF documents and images may also be submitted as part of your assignment. For a short tutorial on creating and submitting PDF documents, please see:

http://tinyurl.com/assignmentpdf

(You may have to log into Google to view this document.)
In addition to a grade, students will receive written feedback from the instructor on their assignments.

To the extent possible, it is recommend that students complete the assignments as the course proceeds rather than waiting until after the course ends.

EXAMINATIONS:

Examinations will be posted on the NPC website at the times indicated in this syllabus. The examinations consist entirely of "short essay" questions. The 3 examinations will cumulatively count for 60% of the student's course grade.

Examinations are non-cumulative; they cover only the material that has been covered since the previous examination. The instructor will provide specific information regarding the content of each examination as the examination time approaches.

NPC uses a voice recognition security system to ensure that the person taking each examination is actually the enrolled student. Before you take your first exam at NPC, you will be required to call into our system so that we can record a sample of your voice. At the outset of taking an exam, you will be given directions on how to comply with this system.

Please have a telephone accessible during the exam as you will be required to call in at the beginning of the exam so our system can verify your identity by matching your voice to the voice sample we have on file for you. In addition, you *may* be prompted at a given point during the exam to call in to explain a response to a random question that you have submitted on the exam.

All examinations are timed. A student may begin the examination any time after it is posted to the NPC website. Once begun, the examination must be completed within 4 hours.

Examinations will be graded on a conventional 0-100 scale. The number of points each question is worth is equal to 100 divided by the number of questions on the examination.

For each examination question, full credit will be awarded if the student:

1) Correctly identifies the legal issue(s) presented by the question

2) Applies the correct law to the legal issue(s) presented (note: full credit may also be awarded if the student's answer comes to an "incorrect" conclusion if the student bases his or her analysis on correct law and supports his or her position in a convincing manner)

3) Presents his or her answer in a clear and understandable manner

The amount of partial credit to be awarded, if any, for an answer that is not complete and correct is at the discretion of the instructor. Instructors are instructed to award partial credit that is proportional to the level of knowledge and legal skill displayed by the student in answering the question.

NPC PLAGIARISM POLICY

All work done by NPC students on assignments, examinations and research projects are expected to be their own work. Quoting other sources as part of analyzing a subject is desirable and necessary in many cases. However, when other sources are quoted or used, they must be properly attributed to the original sources. This applies to direct quotes of sources and to paraphrasing other sources or using ideas obtained from other sources even if the exact text it not used.

Plagiarism means using the materials of others without appropriately citing the source and is an academic offence.

Under the NPC plagiarism policy, a student may not, as part of any assignment or exam submission:

1) quote any text from any other source without:

   a) putting quotation marks around the quotes material;
   AND
   b) appropriately citing the source of the quote

2) Pass off the work of another as his or her own, even if the student does not directly quote from the other source.

Please note that the NPC plagiarism policy does not mean that you cannot quote language from the courseware, textbook or slides as part of an answer to a question on an exam. These are resources that are meant to be used on an exam when applied in an appropriate manner. However, quoting other sources without attribution or quoting the text, slides or courseware without attribution in an assignment is plagiarism.

For more information regarding the NPC Plagiarism Policy, penalties and due process rights where plagiarism is alleged, please see the NPC Plagiarism Policy at:

http://nationalparalegal.edu/pages/Plagiarism%20Policy.pdf

WEEKLY INTERACTION REQUIREMENT

To ensure that all students are involved and participating in the course as the course moves forward, each student enrolled in this course must, at least one during each week, either:

1) Attend a live lecture and take and pass a short quiz given during class
OR
2) Submit at least one assignment
OR
3) Take at least one examination
OR
4) Answer a weekly "interaction" question or questions that will be posted on the "Assignments and Exams" page.

The weekly "interaction" question(s) will be simple and straightforward and will cover material covered in class that week. Answers to these questions should be short (typically 1-3 sentences) and to the point.

This student response (which is necessary only if the student does not attend a live class or take an exam or submit an assignment in the given week) will be graded on a pass/fail basis. The interaction questions will be posted no later than Monday of each week and must be answered on or before the following Monday.

The weekly interaction questions will be posted alongside the assignments. Students who do not attend a live class or take an exam or submit an assignment in the given week will be required to answer the questions presented. Students who did attend a live class or take an exam or submit an assignment in the given week may ignore the question.

Any student who does not fulfill this requirement during a given week will receive a reduction in his or her over-all grade of 2 percentage points from his or her over-all average.

Fulfilling the weekly interaction requirement is particularly important for students receiving financial aid. Federal regulations require the school to withdraw students who go 14 consecutive days without fulfilling an interaction requirement from financial aid and to return any outstanding financial aid money to the government unless the student interacts with the school prior to the time that the withdrawal is completed. If you are unable to fulfill a weekly interaction requirement, is critical that you stay in contact with the school so that other arrangements can be made.

COURSE GRADES

The following formula will be used to calculate final grades

Cumulative exam scores + (assignment points x 10) = raw score

Because exams are worth up to 100 points and assignments up to 4 points each, the maximum raw score is 500. 10 raw points (2% of the raw point total) are deducted for each missed weekly interaction. Extra credit may be available for certain in class activities as may be announced by the instructor.
The following conversion chart is then applied based on the total raw points you have earned:

>474	=	A+
445-474	=	A
420-444	=	A-
395-419	=	B+
365-394	=	B
340-364	=	B-
315-339	=	C+
285-314	=	C
260-284	=	C-
230-259	=	D
<230	=	F

All examinations and assignments are due no later than Sunday, April 28, 2013 at 11:59 PM EASTERN TIME; That's EASTERN time. That means 8:59 PM Pacific time, 9:59 PM Mountain time, 10:59 PM Central time, etc.

Please see the end of this syllabus for a note on NPC course extensions policy!

Lecture and reading assignments schedule

CLASS ONE   **Tuesday, February 5, 2013**

UNIT I   Graph Theory: Finding Optimal Solutions

Lesson 1.   What is the best method to solve a problem?

      Key topics: Describing a graph; Euler's theorem
      Key skills: Determining whether an Euler circuit exists; Finding Euler circuits
      Reading: from Chapter 1, pages 5-13 (up to section 1.3)

CLASS TWO   **Thursday, February 7, 2013**

Lesson 2.   When no perfect solution exists

      Key topics: The Chinese Postman Problem; Real-world applications of graph
                   traversal problems
      Key skills: Solving the Chinese Postman Problem by Eulerizing a graph
      Reading: from Chapter 1, pages 13 (from section 1.3) - 21

Assignment 1 will be posted at this time.

CLASS THREE: **Tuesday, February 12, 2013**

Lesson 3.   A small change in the problem can lead to radically different solutions

      Key topics: Hamiltonian circuits; The Fundamental Principle of Counting; The
                   Traveling Salesman Problem; Algorithms as methods of solving
                   problems (brute-force algorithms, greedy algorithms, heuristic
                   algorithms)
      Key skills: Using the method of trees to find minimum-cost Hamiltonian
                   circuits; Using the nearest-neighbor algorithm and sorted-edges
                   algorithm to solve the Traveling Salesman Problem
      Reading: from Chapter 2, pages 35-47 (up to section 2.4)

CLASS FOUR   **Thursday, February 14, 2013**

Lesson 4.   Getting things done quickly and efficiently – how graph theory can help

      Key topics: Trees; Real-world applications of critical-path analysis
      Key skills: Using Kruskal's algorithm to find minimum-cost spanning trees
      Reading: from Chapter 2, pages 48 (from section 2.4) - 57

Assignment 2 will be posted at this time.

CLASS FIVE   **Tuesday, February 19, 2013**

UNIT II   Probability and Statistics: Analyzing and Manipulating Data

Lesson 5.   Data distributions

      Key topics: Histograms; Properties of a distribution: shape, center, and spread;
                     Normal distributions
      Key skills: Making and interpreting histograms; Calculating the mean,
                     median, quartiles, and standard deviation
      Reading: Chapter 5, pages 165-195

Exam 1 will be posted at this time.

CLASS SIX   **Thursday, February 21, 2013**

Lesson 6.   Data relationships

      Key topics: Scatterplots; Pattern of a scatterplot: form, direction (association)
                     and strength of relationship; Regression; Correlation
      Key skills: Plotting regression lines; Understanding correlations
      Reading: Chapter 6, pages 209-227

CLASS SEVEN   **Tuesday, February 26, 2013**

Lesson 7.   *Data for Decisions (Polls and surveys)*

        Key topics: Populations and samples; Bias; Random samples; Coverage; Observations and experiments; Statistical significance; Parameters and statistics; Sampling distributions; Confidence intervals
        Key skills: Distinguishing between good and bad sampling methods; Designing controlled experiments
        Reading: Chapter 7, pages 241-267

Assignment 3 will be posted at this time.

CLASS EIGHT   **Thursday, February 28, 2013**

Lesson 8.   *Probability: The Mathematics of Chance*

        Key topics: Randomness; Probability models (discrete and continuous)
        Key skills: Implementing probability rules for events; Counting arrangements of objects
        Reading: Chapter 8, pages 281-312

CLASS NINE   **Tuesday, March 5, 2013**

Lesson 9.   *Probability: The Mathematics of Chance, Continued*

        Key topics: Law of large numbers; Central limit theorem
        Key skills: Understanding and applying the central limit theorem
        Reading: Chapter 8, pages 281-312

Assignment 4 will be posted at this time.

CLASS TEN   **Thursday, March 7, 2013**

UNIT III   **Voting Systems: Fairness and Social Choice**

Lesson 10.   *Voting systems*

        Key topics: Preference list ballot; Majority rule and Condorcet's method; May's theorem; Condorcet's voting paradox; Plurality voting and Condorcet's winner criterion; The Borda count and independence of irrelevant alternatives;

        Key skills: Understanding the benefits and limitations of different voting systems

        Reading: Chapter 9, pages 327-337

Exam 2 will be posted at this time.

CLASS ELEVEN   **Tuesday, March 12, 2013**

Lesson 11.   *Voting Systems, Continued*

        Key topics: Sequential pairwise voting and the Pareto condition; Runoff systems and monotonicity; Arrow's impossibility theorem; Approval voting; The Electoral College

        Key skills: Understanding the benefits and limitations of different voting systems

        Reading: Chapter 9, pages 337 – 348

CLASS TWELVE   **Thursday, March 14, 2013**

Lesson 12.   *Manipulability of Voting Systems & Selected Topics*

        Key topics: Sequential pairwise voting and the Pareto condition; Runoff systems and monotonicity; Arrow's impossibility theorem; Approval voting; The Electoral College

        Key skills: Understanding the benefits and limitations of different voting systems

        Reading: Chapter 10, pages 357-369

Assignment 4 will be posted at this time.

CLASS THIRTEEN   **Tuesday, March 19, 2013**

UNIT IV   Game Theory: Conflict Strategies

Lesson 13.   Game theory

      Key topics: Total-conflict games: pure strategies and mixed strategies;
                        Minimax theorem; Partial-conflict games; Prisoners dillema; Nash
                        equilibrium; Chicken
      Key skills: Constructing a payoff matrix; Solving the prisoners dillema
      Reading: from Chapter 15: 529-548

CLASS FOURTEEN   **Thursday, March 21, 2013**

**UNIT VI   Dynamical Systems and Chaos: Biological Populations and Sustaining
                Resources**

Lesson 14.   Populations and resources

      Key topics: The logistic model for biological populations; Nonrenewable
                        resources and reserves; Sustaining renewable resources
      Key skills: Calculating how long a non-renewable resource can last
      Reading: from Chapter 23, pages 829 – 848

CLASS FIFTEEN   **Thursday, March 28, 2013**

Lesson 15.   Dynamical systems and chaos

      Key topics: Dynamical / complex systems; Mathematical chaos; Epidemics as
                        dynamical systems
      Key skills: Showing what behaviors can occur in the logistic model
      Reading: from Chapter 23, pages 848 – 859

Exam 3 will be posted at this time.

All examinations and assignments are due no later than Sunday, April 28, 2013, at 11:59 PM <u>EASTERN TIME</u>; That's EASTERN time. That means 8:59 PM Pacific time, 9:59 PM Mountain time, 10:59 PM Central time, etc.

PLEASE SEE THE FOLLOWING PAGE FOR A NOTE ON NPC DEADLINE EXTENSIONS POLICY.

NPC EXTENSIONS POLICY

1) Extensions that conform to the rules below may be requested from the "assignments and exams" page on the NPC student website.

2) No extensions are possible unless the student has first submitted at least one assignment or examination.

3) No extensions of more than thirty (30) days beyond the deadline are possible for any reason at all.

4) Requested extensions are granted automatically. It is not necessary to give any reason for the request. However, for each day of extension you request, you will be penalized 4 raw points (of 500 that determine your final grade - see page 8 of this syllabus). This accounts for 0.8% of your course grade, per day of extension. This is necessary to compensate for the advantage that students who take more time to do their work enjoy over those who complete their work on time. This also means that a short extension (e.g., a day or two) is unlikely to affect your grade, but a long extension (e.g., two weeks) is guaranteed to affect your grade.

5) The penalty referenced in Paragraph 4 may be waived by an instructor in extreme cases only. Extreme cases include circumstances beyond the control of the student that caused the student to be unable to complete work for *a significant period of time*. Foreseeable life circumstances such as being busy at work or at home, vacations, family occasions or power or internet outages lasting a few days, are foreseeable life circumstances. Extensions may be taken for these reasons (or, for that matter, for any reason at all), but the grade penalty will not be waived for anything short of a true, unforeseeable emergency.