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**CALIFORNIA STATE UNIVERSITY SAN MARCOS**

**College of Arts & Sciences**

**Math 303 Themes for Society**

**Fall 2011**

**Professor: Tejinder S. Neelon, Ph.D.**

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Office hours:.

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| --- |
| MW 8:30-930 , F 1000-1100 or by appointment. |

**Meeting times & place . TuTh 1030-1145 SBSB 1105**

**Tex**t. *Excursions in Modern Mathematics* by Peter Tannenbaum, 7th ed.

Companion website <http://cc.csusm.edu/> and homework assignments are at

<http://www.mymathlab.com/>

**Catalog Description**

Descriptive overviews of selected areas of mathematics that play a visible role in the modern world. Topics include management science and operations research, political science, statistics, computer science, biology, and some late 20th century advancements in pure mathematics. Credit may not be counted toward the mathematics major.

**Prerequisite:**  Completion of the lower-division General Education requirement, Mathematics/Quantitative Reasoning.

**Content.**

**Chapter 1. The Mathematics of Voting: The Paradox of Democracy**

1.1: Preference Ballots and Preference Schedules  
1.2: The Plurality Method  
1.3: The Borda Count Method  
1.4: The Plurality-with-Elimination Method (Instant Runoff Voting)  
1.5: The Method of Pairwise Comparisons  
1.6: Rankings (may be omitted)

**Chapter 2. The Mathematics of Power: Weighted Voting**   
2.1: An Introduction to Weighted Voting  
2.2: The Banzhaf Power Index  
2.3: Applications of the Banzhaf Power Index  
2.4: The Shapley-Shubik Power Index  
2.5: Applications of the Shapley-Shubik Power Index

**Chapter 4. The Mathematics of Apportionment: Making the Rounds**   
4.1: Apportionment Problems  
4.2: Hamilton's Method and the Quota Rule  
4.3: The Alabama and Other Paradoxes  
4.4: Jefferson's Method  
4.5: Adams's Method  
4.6: Webster's Method

**Chapter 5. The Mathematics of Getting Around: Euler Paths and Circuits**

5.1: Euler Circuit Problems  
5.2: What is a Graph?  
5.3: Graph Concepts and Terminology  
5.4: Graph Models  
5.5: Euler's Theorems  
5.6: Fleury's Algortithm  
5.7: Eulerizing Graphs (may be omitted.)

**Chapter 6. The Mathematics of Touring: The Traveling-Salesman Problem**   
6.1: Hamilton Circuits and Hamilton Paths  
6.2: Complete Graphs  
6.3: Traveling Salesman Problems  
6.4: Simple Strategies for Solving TSPs  
6.5: The Brute-Force and Nearest-Neighbor Algorithms  
6.6: Approximate Algorithms  
6.7: The Repetitive Nearest-Neighbor Algorithm  
6.8: The Cheapest-Link Algorithm

**Chapter 7. The Mathematics of Networks: The Cost of Being**   
7.1: Trees  
7.2: Spanning Trees  
7.3: Kruskal's Algorithm  
7.4: The Shortest Network Connecting Three Points  
7.5: Shortest Networks for Four or More Points

**Chapter 10. The Mathematics of Money: Spending it, Saving It, and Growing It**   
10.1: Percentages  
10.2: Simple Interest  
10.3: Compound Interest  
10.4: Geometric Sequences  
10.5: Deferred Annuities: Planned Savings for the Future  
10.6: Installment Loans: The Cost of Financing the Present

Chapter 15. Chances, Probabilities and Odds

15.1: Random Experiments and Sample Spaces

15.2: Counting Outcomes in Sample Spaces

15.3: Permutations and Combinations

15.4: Probability Spaces

15.5: Equiprobable Spaces

15.6: Odds

Chapter 16. Mathematics of Normal Distributions

16.1: Approximately Normal Distributions of Data

16.2: Normal Curves and Normal Distributions

16.3: Standardizing Normal Data

16.4: The 68-95-99.7 Rule

16.5: Normal Curves as Models of Real-Life Data Sets

16.6: Distribution of Random Events

16.7: Statistical Inference

*The following chapters are left for self-reading and class presentations*

**Chapter 3. The Mathematics of Sharing: Fair Division Games**  
3.1: Fair-Division Games  
3.2: Two Players: The Divider-Chooser Method  
3.3: The Lone-Divider Method  
3.4: The Lone-Chooser Method  
3.5: The Last-Diminisher Method

3.6: The Method of Sealed Bids  
3.7: The Method of Markers

Chapter 13. Collecting Statistical Data

13.1 The Population

13.2 Sampling

13.3 Random Sampling

13.4 Sampling: Terminology and Key Concepts

13.5 The Capture-Recapture Method

13.6 Clinical Studies

Chapter 14. Descriptive Statistics

14.1 Graphical Descriptions of Data

14.2 Variables

14.3 Numerical Summaries

14.4 Measures of Spread

**Learning Outcomes & Course Objectives:**

* *Voting and Elections:* Construct and interpret a preference schedule for an election involving preference ballots. Implement the plurality, Borda count, plurality-with-elimination, and pairwise comparisons vote counting methods. Rank candidates using recursive and extended methods. Identify fairness criteria as they pertain to voting methods. Understand the significance of Arrows' impossibility theorem. Weighted voting system.
* *Fair Division*: State the fair-division problem and identify assumptions used in developing solution methods. Recognize the differences between continuous and discrete fair-division problems. Apply the divider-chooser, lone-divider, lone-chooser, and last-diminisher methods to continuous fair-division problems. Apply the method of sealed bids and the method of markers to discrete fair-division problems.
* *Apportionment*: State the basic apportionment problem. Implement the methods of Hamilton, Jefferson, Adams, and Webster to solve apportionment problems. State the quota rule and determine when it is satisfied. Identify paradoxes when they occur.
* *Counting and Probability*: Apply the multiplication rule, permutations, and combinations to counting problems. Understand the concept of a probability assignment. Identify independent events and their properties. Use the language of odds in describing probabilities of events.
* *Descriptive and Inferential Statistics*: Identify whether a given survey or poll is biased. List and discuss the quality of several sampling methods. Identify components of a well-constructed clinical study. Define key terminology in the data collection process. Estimate the size of a population using the capture-recapture method. Interpret and produce an effective graphical summary of a data set. Identify various types of numerical variables. Interpret and produce numerical summaries of data including percentiles and five-number summaries. Describe the spread of a data set using range, interquartile range, and standard deviation. Describe an appropriate sample space of a random experiment. Identify and describe an approximately normal distribution. State properties of a normal distribution. Understand a data set in terms of standardized data values. State the 68-95-99.7 rule. Apply the honest and dishonest-coin principles to understand the concept of a confidence interval.
* *Routes and Networks*: Identify and model Euler circuit and Euler path problems.

Understand the meaning of basic graph terminology. Classify which graphs have Euler circuits or paths using Euler's circuit theorems. Implement Fleury's algorithm to find an Euler circuit or path when it exists. Eulerize and semi-Eulerize graphs when necessary. Recognize an optimal Eulerization (semi-Eulerization) of a graph.

* *Financial Mathematics:* Work with Percentages. Compute and compare Simple and

Compound Interest. Understand Geometric Sequences. Finance of Deferred Annuities, Planned Savings for the Future, Installment Loans and The Cost of Financing the Present

Homework/ Quizzes The assignments will scheduled online [www.mymathlab.com](http://www.mymathlab.com). There are limited number of attempts for each problem. Each quiz will have maximum four questions. These quizzes might be any fifteen-minute slot during the class. There is a cushion of 20% points on this component of the assessment. That is, you could miss or score low on a certain number of quizzes & homework assignments and still receive full points on HW/Quizzes. *Therefore, no make-up quiz will be given regardless of your reason for missing the quiz. No calculators are allowed for these quizzes.*

# Grading[[1]](#footnote-1). You must resolve any issue regarding your score on a particular quiz /exam within two weeks from the day that the graded quiz/exam was returned in the class. It is your responsibility to collect back your graded exams/quizzes in time. The uncollected quizzes/exams will be discarded.

F: 0%-49% D-: 50%-54% D: 55%-59%

C-: 60%-64% C: 65%-69%, C+: 70%-75%

B-: 76%-79% B: 80%-84% B+: 85%-88%

A-: 89%-90% A: 91%+

Distribution of points is as follows: (**Drop one component from a-d.)**

1. Test I 20%;
2. Test II 20%;
3. Homework (drop 20%) 20%;
4. Other (Class presentations, Quizzes etc.) 20%

Cumulative Final 40%;

1. *The above content and requirements are tentative and subject to change according to time constraints and other factors as determined by the instructor. The assessment/grading criteria can possibly change too but your grade can only get better as a result of any modification in the grading scheme.*

   Last updated 8/29/11 [↑](#footnote-ref-1)