MAT 124 Finite Mathematics

Department of Mathematics

Southern Connecticut State University

I. Catalog Description

Finite mathematics for business and the social sciences. Topics include exponential and logarithmic functions with applications to interest and annuities, systems of linear equations and matrices, linear inequalities and linear programming, the simplex method, and set notation and basic probability.

II. Purpose

The purpose of this course is to provide students with the skills needed for for using quantitative techniques and models in problems arising in economics, finance, marketing, management and the social sciences. It also will provide students with the quantitative reasoning skills needed to satisfy the mathematics general education requirement for the University Liberal Education Program.

III. Credit

(A) MAT 124 carries three semester-hours of university credit.

(B) MAT 124 fulfills the Quantitative Reasoning requirement for the Liberal Education Program

(C) MAT 112 or MAT 120 is a prerequisite for MAT 124.

IV. Liberal Education Program

This course satisfies the University's Liberal Education Program (LEP) requirement in Quantitative Reasoning (QR). It addresses the key elements of the QR requirement as indicated in Section VIII: Course Objectives. Further, as a Tier 1 LEP course, it will do the following:

(A) Address at least one *Area of Knowledge and Experience* through the choice of data sets or word problems that are applied to business or the social sciences, *Global Awareness* (for example, data measuring poverty levels in different countries) or *Social Conflict and Consensus* (for example, application problems involving business such as break-even analysis or communication networks). Examples of data could also be chosen to introduce other *Areas of Knowledge* such as *American Experience* (for example, data measuring population changes in America). **[GA, SS, AE]**

(B) Incorporate at least one *Discussion of Values*. For example, *Rational Thought* can be emphasized by asking students to interpret and make predictions from a given mathematical model. For example, students might be asked to interpret the meaning of the parameters in an exponential model of an annuity or they might be asked about the limitations of the model. *Civic Engagement* is another area that could be discussed by choosing to model data or applications that involve business decisions that directly affect students' local communities. **[RT, CE]**

(C) Address at least one *Embedded Competency* in a significant manner. Instructors may choose to address this requirement by incorporating one of the following requirements into their course: *Oral Communication* by requiring students to present the results of their work through oral presentations, *Interpersonal Effectiveness* by requiring students to work in group settings, *Information Literacy* by requiring students to locate and evaluate their own information and/or data for a project, or *Creative Thinking* by requiring students to create a model for a set of data or scenario in which they have not already been told what type of model is most appropriate. **[OC, IE, IL, CT]**

(D) Present the Quantitative Reasoning aspects of Finite Mathematics in context. The key elements QR1–Quantitative Situations, QR2–Quantitative Data, QR3–Methods, QR4–Reliability of Data and Solutions, and QR5–Mathematical Process are addressed in the course objectives listed below.

V. Prerequisites

The student must satisfy one of the following two prerequisites:

(A) pass MAT 112 with a grade of C- or better;

(B) establish a placement level appropriate for the course.

VI. Format

MAT 124 meets for 3 contact hours per week throughout a standard academic semester and is conducted primarily in a lecture and discussion format. Graphing will be included and technology-assisted.

VII. Quantitative Reasoning Key Elements

(A) **QR1**: Quantitative Situations - Identifying the essential quantitative elements in both routine and novel situations and understanding the relationships between those quantitative elements, and producing mathematical models appropriate for the intended analysis (e.g., writing equation(s) to represent the situation).

(B) **QR2**: Quantitative Data - Representing quantitative information in both technical and common language by using symbolic, graphical, and tabular formats, and drawing correct inferences from quantitative information through the interpretations of such representations.

(C) **QR3**: Methods - Acquiring the tools and methods necessary to resolve both routine and novel quantitative questions, including a correct sequencing of procedures, and using them appropriately, given the nature and constraints of a situation. In addition to using knowledge previously acquired in intermediate algebra, students will demonstrate proficiency with information presented in numerical or statistical form and mathematical concepts of growth and decay with their applications (e.g., linear, quadratic, exponential, etc.).

(D) **QR4**: Reliability of Data and Solutions - Correctly evaluating the level of accuracy stated or implied for given data, and assessing the correctness and accuracy of an analysis, including the assessment of the method and model used and the reasonableness of the solution.

(E) **QR5**: Mathematical Process - Using discovery (e.g., exploration and pattern-recognition), conjecture, and testing to develop mathematical formulas, theorems, and then giving persuasive mathematical arguments to establish their validity.

VIII. Course Objectives

In addition to satisfying LEP Tier 1 requirements, MAT 124 has specific course objectives. By the end of the course, a successful student should be able to do the following:

(A) Sketch the basic shape and behavior of the basic graphs of linear, exponential, logarithmic, absolute value, quadratic, and power functions without using a graphing calculator. Sketch basic transformations of these graphs without a calculator.

(B) Construct and use appropriate functions to model applications. In particular, the exponential function and logarithmic functions should be used to model and solve problems involving business and finance applications. (QR1, QR2, QR3, QR4, QR5)

(C) Use systems of linear equations and matrix models to model business applications. Algebraically solve systems of two equations and use row-reduction and/or the matrix inverse to solve larger systems of equations. (QR1, QR2, QR3, QR4, QR5)

(D) Use systems of linear inequalities to model optimization problems in business, both algebraically and geometrically. (QR1, QR2, QR3, QR4, QR5)

(E) Understand how to use set notation and solve basic probability and counting problems. (QR1, QR2, QR4, QR5)

IX. Outline

(A) Review of Elementary Functions. (10 %)

1. Review of function notation.
2. Review of the graphs of linear and quadratic functions.
3. Review of the graphs of basic functions (x^2, x^3, $\sqrt{x}$, $\sqrt[3]{x}$, $|x|$) with transformations of these graphs.

(B) Exponential and Logarithmic Functions. (20 %) **[QR3]**

1. The basic exponential functions (including the natural exponential function) and their graphs.
2. The basic logarithmic functions and their graphs.
3. The laws of exponents and the properties of logarithms.
4. Analytical and graphical solution of exponential and logarithmic equations.
5. Applications of exponential functions to the mathematics of finance (simple and compound interest, annuities) **[QR1, QR2, QR4, QR5]**

(C) Systems of Linear Equations; Matrices (30 %) **[QR3]**

1. Review of solving systems of linear equations in two variables using substitution and elimination
2. Applications of linear systems to break-even analysis and market price equilibrium (supply/demand equations). **[QR1, QR2, QR4, QR5]**
3. Systems of linear equations and augmented matrices.
4. Gauss-Jordan Elimination.
5. Basic matrix operations.
6. Inverse of a square matrix; using the inverse to solve a matrix equation.
7. Applications of systems of linear equations (Leontief input-output analysis, Markov chains) **[QR1, QR2, QR4, QR5]**

(D) Systems of Linear Inequalities and Linear Programming (20 %) **[QR3]**

1. Review of solving systems of linear inequalities in two variables.
2. Linear programming in two dimensions (geometric approach).
3. The Simplex Method–maximization with problem constraints of the form $\leq$. **[QR1, QR2, QR4, QR5]**
4. The Dual–minimization with problem constraints of the form $\geq$. **[QR1, QR2, QR4, QR5]**

(E) Sets, Counting Methods, and Probability (20 %) **[QR3]**

1. Basic Counting Principles.

2. Permutations and combinations.
3. Set Notation, Sample Spaces, Events, and Probability. [**QR1, QR2, QR4, QR5**]
4. Union, Intersection, and Complement of Events.
5. Conditional probability and Independence. [**QR1, QR2, QR4, QR5**]

X. Assessment

Individual instructors may vary assessment modes, but typically grades will be based on a combination of homework assignments, quizzes, and exams.

	QR 1 Quantitative Situations	QR 2 Quantitative Data	QR 3 Methods	QR 4 Reliability of Data and Solutions	QR 5 Mathematical Process
Homework	Individual instructors decide which QR will be assessed appropriately.				
Quizzes	Individual instructors decide which QR will be assessed appropriately.				
Tests	✓	✓	✓	✓	✓
Final Exam	✓	✓	✓	✓	✓

XI. Recommended Texts

(A) Barnett, Ziegler, and Byleen, *Finite Mathematics*.

(B) Goldstein, Schneider, and Siegel, *Finite Mathematics and Its Applications*.

(C) Tomastik and Epstein, *Applied Finite Mathematics*.

(D) Sekhon, *Applied Finite Mathematics*, `http://cnx.org/contents/8c-1jjEY@5.1:DjaX961v@2/Linear-Equations`.

XII. Waiver Policy

This course may be waived.

XIII. Bibliography

(A) Barnett, Ziegler, and Byleen, *Finite Mathematics*.

(B) Goldstein, Schneider, and Siegel, *Finite Mathematics and Its Applications*.

(C) Tomastik and Epstein, *Applied Finite Mathematics*.

(D) Sekhon, *Applied Finite Mathematics*, `http://cnx.org/contents/8c-1jjEY@5.1:DjaX961v@2/Linear-Equations`.

XIV. Preparation

Proposed outline prepared by T. Bennett, March 2016. Includes revisions of September 2017

Approved by the MDCC, 9-0-0, September 28, 2017.
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