Math 636 - Mathematical Modeling

Lecture Notes – Introduction to Mathematical Modeling

Joseph M. Mahaffy,
⟨jmahaffy@sdsu.edu⟩

Department of Mathematics and Statistics
Dynamical Systems Group
Computational Sciences Research Center
San Diego State University
San Diego, CA 92182-7720

http://jmahaffy.sdsu.edu

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Outline

Contact Information

Professor Joseph Mahaffy

Office	GMCS-593
Email	**jmahaffy@sdsu.edu**
Web	http://jmahaffy.sdsu.edu
Phone	(619)594-3743
Office Hours	T: 15:30-17:20 at MLC and Th: 15:30-17:20 at GMCS 593 and by appointment

Basic Information: Text/Prerequisites

No Text: Notes and Homework are available on my website
http://jmahaffy.sdsu.edu/courses/f18/math636/Math_636_main.html

- This course covers a wide range of Mathematical techniques and Applications from a variety of fields.
- My bias will favor ***biological applications*** with a ***dynamical systems*** approach.

Formal Prerequisites: Mostly, courses required for admission to the **M.S. program** in **Applied Mathematics**

- Calculus
- Linear Algebra
- Differential Equations
- Numerical Analysis
- Programming

Basic Information: Grading

Approximate Grading

Homework, including WeBWorK*	50%
Midterm and Final+	30%
Article Reviews	5%
Project	15%

* Written HW with good graphs and programs and some online/WeBWorK HW – MatLab will be the primary programming language.

\+ These exams may be Take-Home. Final: Tuesday, Dec 18: 15:30 – 17:30.

Expectations and Procedures, I

- Most class attendance is OPTIONAL — Homework and announcements will be posted on the class web page. If/when you attend class:
  - Please be on time.
  - Please pay attention.
  - Please turn off cell phones.
  - Please be courteous to other students and the instructor.
  - Abide by university statutes, and all applicable local, state, and federal laws.

Expectations and Procedures, II

- Please, turn in assignments on time. (The instructor reserves the right not to accept late assignments.)
- The instructor will make special arrangements for students with documented learning disabilities and will `try` to make accommodations for other unforeseen circumstances, *e.g.* illness, personal/family crises, etc. in a way that is fair to all students enrolled in the class. ***Please contact the instructor EARLY regarding special circumstances.***
- Students are expected ***and encouraged*** to ask questions in class!
- Students are expected ***and encouraged*** to to make use of office hours! If you cannot make it to the scheduled office hours: contact the instructor to schedule an appointment!

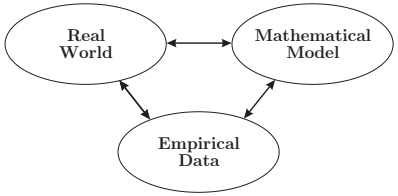
Expectations and Procedures, III

- Don't miss exams and final! The instructor reserves the right to schedule make-up exams and modify their form and style, and/or base the grade solely on other work (including the final exam).
- Project will include both an oral and a written part with the written part weighted more heavily. The project must be related to methods taught in class (No Statistics!) and must demonstrate interesting mathematical techniques and programming connected to real world data.
- ***Academic honesty***: Submit your own work. Any cheating will be reported to University authorities and a **ZERO** will be given for that HW assignment or Exam.

MatLab and Maple

- Students can obtain **MatLab** from EDORAS Academic Computing.
- Google **SDSU MatLab** or access **https://edoras.sdsu.edu/ download/matlab.html**.
- **MatLab** and **Maple** can also be accessed in the **Computer Labs GMCS 421**, **422**, and **425**.
- A discounted student version of **Maple** is available.

What is a Mathematical Model?



- A ***mathematical model*** is a representation of a real system.
- It is an iterative process used to obtain a better understanding of some observation from the ***Real World***.
  - The ***Real World*** is abstracted into a symbolic idea, which is expressed as ***mathematical equations*** or a ***Mathematical Model***.
  - ***Empirical Data*** are collected about the system of interest, and these data are compared to the output from the ***Mathematical Model***.
  - An ***iterative process*** provides better approximations and greater insight into the underlying principles from the original problem from the ***Real World***.

What is a Mathematical Model?

- The essence of a ***good mathematical model*** is that it is simple in design and exhibits the basic properties of the ***real system***.
- A ***good mathematical model:***
  - Should be testable against empirical data.
  - Should iteratively lead to improved mathematical models.
  - May suggest improved experiments to highlight a particular aspect of the problem, which in turn may improve the collection of data.
  - It is an evolutionary process.