MATH 360 – Draft Syllabus

Week	Date	Lecture (Tues, 9:30am)	Date	Lab (Thurs, 9:30am)
1	Sept 6	-Intro/Course Admin **Optimization:** single-variable optimization, constraints	Sept 8	**Account setup** **MATLAB tutorial:** basic operations, built-in functions, help resources, differentiation, solving equations, graphing functions. **Modeling Lab 1:** Simple single-variable optimization
2	Sept 13	**Optimization:** multivariable optimization, partial derivatives, constraints, method of Lagrange multipliers, brief overview of optimization with constraints (linear programming, etc.)	Sept 15	**MATLAB tutorial:** user-defined functions, scripts/m-files, for loops, while loops, if statements **Modeling Lab 2:** Shortest path routing on road networks – create pseudocode for Dijkstra's algorithm.
3	Sept 20	**Optimization:** discrete optimization, graphs, networks, standard problems (shortest path, travelling salesmans, etc) -Dijkstra's algorithm for shortest path	Sept 22	**Modeling Lab 3:** Shortest path routing on road networks – write the code for Dijkstra's algorithm and apply it to a real-world road network in two cases: (1) congested, (2) uncongested traffic.
4	Sept 27	**Discrete time models:** recurrence relations, fixed points, cobwebbing, exponential growth model	Sept 29	**MATLAB Tutorial (short):** plotting data **Modeling Lab 4:** -the Beverton-Holt model, $x_{n+1}=\frac{R_0 x_n}{1+(ax_n)^b}$ Consider initially b=1, but then consider varying b>1, etc.
5	Oct 4	**Discrete time models:** logistic map, period doubling and discrete chaos	Oct 6	**Modeling Lab 5:** The discrete Ricker model, whooping crane population (project 13 of Hillen's projects) -do bifurcation diagram and period doubling route to chaos.
6	Oct 11	**Discrete time models:** multiple species, compartmental models, stage-structured models?	Oct 13	**Midterm (project-based)** possible types of exam questions: (1) Give a model and ask students to

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				analyze it (2) Give a real-world problem and ask students to build a model to solve or study it. (3) Give a problem and ask students to compare the results or validity of two modelling approaches to the problem.
7	Oct 18	**Discrete time models:** stochastic discrete time models, individual-based discrete time models	Oct 20	**MATLAB Tutorial (short):** drawing random numbers and distributions **Modeling Lab 6:** revisit project 3 (whooping crane) but as an individual-based discrete time model with stochasticity
8	Oct 25	**Continuous time models:** 1-D 1st order systems Fixed points, stability, phase portraits, the exponential and logistic (deterministic) models	Oct 27	**MATLAB Tutorial:** visualizing solutions to ODEs using DFIELD, PPLANE, DSOLVE, initial conditions. **Modeling Lab 7:** the deterministic logistic equation in continuous time
9	Nov 1	**Continuous time models:** -continuous stochasticity, birth-death processes, gillespie algorithm	Nov 3	**Modeling Lab 8:** the logistic equation in continuous time, with stochasticity using the Gillespie algorithm (compare deterministic-project 5 vs. Stochastic)
10	Nov 8	**Continuous time models:** Bifurcation, oscillations and limit cycles	Nov 10	**Modeling Lab 9:** Arms race (from Hillen's projects, or Mooney & Swift)
11	Nov 15	**Empirical Modelling:** covariance and correlation, linear dependence, fitting lines	Nov 17	**Modeling Lab 10:** Lynx Fur Returns (example 4.8 in the text) OR project 4.1 in the text: England and Wales population (linear, power, exponential models) OR project 4.3 in the text, bald eagles and DDT – only looks at linear models
12	Nov 22	**Empirical Modelling:** curvilinear models (powers,	Nov 24	**Modeling Lab 11:**

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		periodic functions, logarithmic models), R^2 for nonlinear models		continue Lynx fur returns OR project 4.5 from the text, alligator vent snout length, or project 4.9 algae growth in the Adriatic
13	Nov 29	**Empirical Modelling:** linearization of models? Multiple regression? (probably not?) Or just review?	Dec 1	**Final Exam** OR if do multiple regression – project 4.13, body fat model, from the text