BIO 480 Exam 2 Topics
 Includes Haefner Ch 4 & 6, Keen & Spain handout (Silver Springs Model)

Model development - Quantitative Methods

FDE versus DE models
Compartment Models
 Developmental approach
diagrammatic
mathematical
differential equations, forcing functions
transfer functions - What are the possible types?
solution requirements
compputer (modelmaker program, external flows)

Silver Springs model
description
 predator-prey style of feeding functions
 external flows
 behavior
 strengths/weaknesses

Quantitative numerical methods for DEs
 Numerical errors in computing
 Euler’s method for solving DEs
 How does it work?
 Effects of time step size on errors
 Better methods? (Runge-Kutta second order)
 Logistic model - the DE version
 Effects of time step size on solution behavior

Root Finding Methods (square root of 7 example)
 Why needed? What is a root?
 Linear Interpolation Method
 How does it work?
 Newton’s Method
 How does it work?
 Analytical vs. numerical derivatives
 Exit tests
 Variables and precision (float vs. double)

Organism-Environment Interactions & Energy Budget Models
 What environmental factors are important?
 Steady-state budgets (constant flows, in=out, what is ignored?)
 Energy exchange processes:
 Radiation exchange – visible solar vs. infrared
 Emitted radiation (Stefan-Boltzmann Law)
 emissivity
 Convection
 convection coefficient, effects of wind speed, organism size
 Metabolic energy (effects of temperature on)
 Evaporative cooling (effects of temperature)
 Insulation effects (surface vs. body core temperature)
 Total budget for organisms – behavior and general effects
 wind evaporation
 air temperature organism size
 radiation dew formation
 humidity