A Selection of Past Math Modeling Project Topics

Pollution Models:

Carcinogens in smoke (How are neighboring apartments to a smoker affected?)

Smoke from a fire at the base of Shanghai tower (How are tourists affected at different levels? When is it safe to descend?)

Predator Prey Models:

Tumor remission – tumor cells vs. fighter cells

Food cycle: A eats B eats C eats A

Predator with two prey, one of which is elusive

Predator prey with a disease in the prey that spreads to the predator

Sustainability of colonization of mars; predator = humans, resources =prey.

Predator-Prey with hibernation (How does hibernation affect the interaction of blackbears and white-tail deer?)

SIR (epidemic) Models:

Unemployment as an epidemic

Viruses spread by social networking

Zombies as an epidemic

Ebola outbreak

Sars

Is Aids currently an epidemic?

Effects of vaccination on the SIR model

Modeling the spread of crime (The model considered 3 sources: family, school and neighborhood.)

Black Death (How the nature of the epidemic varied significantly from one region in France to another and why.)

Cooperation/competition models:

Cooperation evolving into competition between countries sharing a resource

Companies in competition

Nerds/bullies/non-conformists in high school

Retail stores/criminals/police

Gentrification of a neighborhood

Predicting Elections with a competition model

Modeling the Breast Cancer Drug Herceptin: Pharmacokinetics and Interaction with Cancer Cells

Traffic Flow:

Traffic on the Mass Ave Bridge and its effect on biking

Is the "keep right except to pass" rule effective?

Shocks caused by movement of rock in an earthquake

Seminov spontaneous combustion model:

Fatal effects of MDMA, (Ecstasy), in high temperature environments

Change of state of financial markets – stable/volatile/combustive

Doomsday/extinction:

Acid rain and bass

Evacuation of Long Island over bridges during Hurricane Sandy

Various growth/decay models

Gentrification: Modeling income changes in renter dominated neighborhoods

Dynamics of growth of English vocabulary since 450 AD, (The project used the Edict Virtual Language Center, http://www.edict.com.hk/, for data. It provides a Word Frequency Text Profiler, and a Unique Words Text Profiler.)

Analysis of Japan population decline

Rate of change of pheromones on ants' foraging path

Changes in Carrying Capacity with Applications to Population Models (The model modified standard models by considering varying capacities and discontinuities due to natural disasters, changing ecosystems, damage to food source, and adaptation of species.)

Modeling Food Supply (The project modeled relationship between products, suppliers and consumers in various retail scenarios.)

Modeling Social Networks with a Spontaneous Combustion Model

Predicting Elections with a Competition Model

Predator-Prey Models with Hibernation
(Black bears vs Whitetail deer – how hibernation affects the predator-prey interaction)

Modeling the Spread of Crime with the SIR Epidemic Model
(3 interactions considered: family, school, and neighborhood)

Gentrification: Modeling Income Changes in Renter Dominated Neighborhoods

Modeling the Breast Cancer Drug Herceptin: Pharmacokinetics and Interaction with Cancer Cells

Changes in Carrying Capacity with Applications to Population Models (modified standard models by considering varying capacities and discontinuities due to natural disasters, changing ecosystems, damage to food source, adapting species)

Modeling Food Supply, (modeled relationship between products, suppliers and consumers in various scenarios)