HUMBOLDT-UNIVERSITÄT ZU BERLIN
INSTITUTE FOR THEORETICAL BIOLOGY

Theoretical Biology Modeling

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Lecture: Monday 08:15 H12
Exercises: Day? time? hr

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1. Exercise **Hand out: 20.10.08, Hand in: 27.10.08, in the lecture**

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1. **Radioactive Decay.**

A radioactive compound decays to 10% after 46 days.

1. Please calculate the half-life!
   (a) When has 99% decayed?
   (b) What isotope is it?
2. **In a biochemical system a concentration c is given by:**

$$\frac{dc}{dt} = k_1 - k_2 c$$

   (a) Calculate the steady state!
   (b) What is the temporal solution of this differential equation?
   (c) The following measurements are given.

Time	1	2	3	4	5
Concentration	2.2	2.9	3.3	3.6	3.8

   Plot these time series data!
   (d) Estimate the rate constants k_1 and k_2 .
   (e) What has to be plotted in order to apply linear regression?

3. **The yield of an ecosystem.**

The yield of an ecosystem can be analyzed by means of a model of a single species. The equation for logistic growth is then modified to include a yield term E:

$$\frac{dx}{dt} = r \cdot x \cdot \left(1 - \frac{x}{K}\right) - E.$$

The yield is considered to be proportional to the population size x, according to: $E = a \cdot r \cdot x$, with $a > 0$.

   (a) Please calculate the steady state(s) and analyze their stability!
   (b) Please calculate the stationary yield, E^{st}. State the maximal stationary yield as a function of a.