Exam I Review Topics

**Reading:** Chapters: 1-3 excluding 2.2.5, 3.2.1

**Theory:**
- Components of a modeling process
- Model classes
  - **Discrete models**
    - Definition of a fixed point
    - Linear stability analysis of a fixed point in 1D and 2D
    - Definition and properties of a bifurcation diagram
    - Jury conditions
    - Basic population dynamic models (Logistic, Beverton-Holt, Nicholson-Bailey)
  - **ODE models**
    - Definition and properties of nullclines
    - Definition and properties of autonomous ODE systems
    - Definition and classification of equilibria of 1D and 2D systems
    - Elementary bifurcations and their properties

**Methods**

**Discrete models**
- Cobwebbing of 1D models
- Finding fixed points of 1D models, determining their stability
- Finding k-periodic orbits of 1D models, determining their stability
- Linearization of 2D discrete models - finding Jacobian
- Determination of fixed points and their stability in 2D models
- Computation of bifurcation diagrams for 1D and 2D models
- Interpretation of bifurcation diagrams

**ODE models**
- Determination of equilibria and their stability of 1D models
- Determination of equilibria and their classification for 2D models
- Phase-plane analysis of 2D models
- Bifurcation analysis of 1D systems
- Non-dimensionalization of a model
- Basic population models (Logistic, Fishery, Reaction kinetics models, Epidemic models)