Homological algebra

In some sense it is the study of "complexes"

In topology: Singular chains $C_{n+1}(X) \xrightarrow{d_{n+1}} C_n(X) \xrightarrow{d_n} \dots$ ⇝ Homology groups

In various situations one gets long exact sequences attached to geom. situations (Meyer-Vietoris, Excision, ...)

In algebra: R ring, E, F R-modules ⇝ $\mathrm{Hom}_R(E,F)$, $\mathrm{Ext}^*(E,F)$ ...
$E \otimes_R F$, $\mathrm{Tor}(E,F)$ ...

And again s.e.s of R-modules ⇝ l.e.s Exts and Tors

In alg. geometry: Sheaf cohom.

In group theory: Group cohom.

⋮

⇝ Homological algebras gives a common framework to all of these constructions

Content:

0. Categories, functors
1. Chain complexes in abelian categories
2. Derived functors
3. Tor, Ext, universal coefficient theorems
4. Spectral sequences
5. Derived categories

Rmk: No sheaves (follow the course on schemes)

Structure of the seminar:

- Next week's lecture by me
- After that every lecture is prepaired by 2 students as well as the exercise sheet.
- Each "team" will give two lectures during the semester
- In addition each student has to do:
  1) Type notes for one lecture in latex (not his own)
  2) Type solutions for one sheet

  } ⇒ Grade

  3) Attend all lectures unless you excuse yourself in advance with a good reason.

Payoff: · No exam
· We'll combine the written material into a textbook (see moodle for last years)

Organization: · You'll know your topic two weeks in advance
· On thursday befor your talk, we meet at 4pm in my office to discuss your talk, answer questions etc
· You have two weeks to hand in the lecture notes (to me) and solutions (to Eric Chen).
· Send me an e-mail if you'd like to attend the seminar (possibly indicating a team partner) as soon as possible.