Summary

Commutative algebra is not just an important mathematical subject in itself – it also provides the background for algebraic geometry and algebraic number theory. That’s why basics of commutative algebra should be studied by every mathematician. This course covers exactly that. We will go through the basic formalism of commutative algebra (at times rather abstract), motivating the formal constructions by geometric and number-theoretic applications.

We will have a midterm exam in class and a 3-hour final during the finals week.

An important role in the course is played by homework (see the assignments and due dates below). The homework exercises are not hard, and are very important for learning the material. Note that the notes contain solutions of the homework exercises. You should try to solve the exercises by yourself, and look at the solutions only if you are stuck (or after you wrote your own solution). At the end, you need to write the solution in your own words. Copying solutions from the notes will result in reduction of score and, more importantly, in poor performance at the exams (which cost 70% of the grade).

Note: The notes include some unassigned exercises with solutions. Try to solve them too – this will help you understand the material better.

Additional references


**Grading policy**

**Formula:** Homework 30% + Midterm 25% + Final 45%

**Midterm:** will be taken in class on Thursday, October 22, 2015.

**Final:** 3-hour exam during the exam week.

**Homework policy:** See below for assignments with due dates. Homework must be submitted to me in class on the due date, except Friday Dec. 4, when it should be brought to my office by 3pm. Graded homework will be returned in class a week later. Late homework will absolutely not be accepted. If you expect to miss a homework and have an official excuse from S3, then you need to notify the instructor of such a case via email before the due time, and the official email from S3 must be sent to the instructor within 24 hours after the due time.

**Plan of lectures and assignments**

The following topics and assignments refer to Lecture Notes by Allen Altman and Steven Kleiman.

The notes are available at the course webpage and at the URL http://www.centerofmathematics.com/wwcomstore/index.php/commalg.html in digital and print forms. The digital form is free of charge; the print form is a perfect-bound paperback, and costs $19.95.

Assigned problems are indicated below, after the date they’re due. The numbers between parentheses refer to subsections which are exercises in the Lecture Notes.

1. R.09/10 — Rings and ideals — Write up for 09/22: (1.7), (1.10), (1.14), (1.15), (1.17).
2. T.09/15 — Prime ideals — Write up for 09/22: (2.11), (2.16), (2.18), (2.22), (2.23).
3. R.09/17 — Radicals — Write up for 09/22: (3.9), (3.13), (3.17), (3.18), (3.32), (3.39).
5. R.09/24 — Homological algebra I — Write up for 09/29: (5.11), (5.15), (5.16), (5.24), (5.26), (5.29).
6. T.09/29 — Homological algebra II — Write up for 10/6: (6.3), (6.9), (6.16), (6.17).
7. R.10/1 — Homological algebra III — Write up for 10/6: (7.2), (7.9), (7.15), (7.17), (7.20).
8. T.10/6 — Tensor products — Write up for 10/15: (8.7), (8.9), (8.16), (8.24), (8.25), (8.26).
9. R.10/8 — Flatness — Write up for 10/15: (9.4), (9.15), (9.17), (9.18), (9.25), (9.28).
10. R.10/15 — Finitely generated modules — Write up for 10/22: (10.6), (10.8), (10.16), (10.22), (10.31), (10.35).

11. T.10/20 — Localization of rings — Write up for 10/27: (11.4), (11.7), (11.10), (11.18), (11.24), (11.32).

12. R.10/22 — Midterm exam, in class (covering lecture material through 10/15)


16. R. 11/5 — Noether normalization — Write up for 11/10: (15.2), (15.3), (15.8), (15.11), (15.12).


18. R.11/12 — Associated primes — Write up for 11/17: (17.6), (17.7), (17.11), (17.16), (17.22), (17.26).

19. T.11/17 — Primary decomposition — Write up for 11/24: (18.7), (18.8), (18.17), (18.18), (18.22), (18.26).


21. T.11/24 — Hilbert functions — Write up for 12/1 (20.5), (20.6), (20.9), (20.10), (20.19).


23. R.12/3 — Completion — Write up for 12/4: (22.4), (22.6), (22.11), (22.14), (22.19), (22.21).

24. T.12/8 — Discrete valuation rings — Write up, optional: (23.6), (23.9), (23.12), (23.13), (23.17), (23.22).

25. R.12/10 — Dedekind domains — Write up, optional: (24.5), (24.6), (24.8), (24.12), (24.13).