List of projects:

1. Explain the main results and write a pseudocode for the Groebner Walk algorithm from “Converting Bases with the Groebner Walk” by S. Collart, M. Kalkbrener, and D. Mall, J. Symbolic Computation 24 (1997) 465-469 (see Blackboard).

2. Matrices and monomial orderings: read “Term Orderings on the Polynomial Ring” by L. Robbiano, Proc. of EUROCAL’85 (see Blackboard), understand the main results, summarize them, and give a proof that there are continuum many different monomial orderings.

3. Write Maple code for an algorithm of your choice explained in the course (e.g., the division algorithm), estimate its complexity, and supply testing examples to verify the complexity in practice.

4. Identify and explain the main results in Chapters 10 and 11 of “Algorithms in Real Algebraic Geometry” by Saugata Basu, Richard Pollack, Marie-Françoise Roy, Springer (2006) (available at the GC library), substituting the field of real numbers instead of a real closed field if needed for simplicity.

5. Identify and explain the main results of “Length of polynomial ascending chains and primitive recursiveness” by G. Moreno Socias, Math. Scand. (1992) 181-205 (see Blackboard).

6. Identify and explain the main results of “An Ackermannian polynomial ideal” by G. Moreno Socias, Lecture Notes in Computer Science 539 (1991) 269-280 (see Blackboard).

7. One project from Projects 3,11,12,14 from Cox-Little-O’Shea, pp. 531-533.

8. Choose one or several sections from Chapter 6 of Cox-Little-O’Shea (on Robotics), give an overview and present solutions of selected (of student’s choice) exercises.

9. Extend the lecture notes and correct the typos in the current version.

10. Review the first three sections of the differential algebra lecture notes

http://qcpages.qc.cuny.edu/~aovchinnikov/MATH87800/notes.pdf

and compare these results with the results from our course, explaining the subtleties specific to differential algebra.

11. Find articles that discuss the complexity of Groebner basis computation (both lower and upper bounds), including the special case of dimension zero, and summarize the results.

12. Find articles that discuss the effective Nullstellensatz and summarize the results.