Syllabus

Topics in Algebra I

Course Name	Course type (credit/hours)	전선(3/3)		Course code	
	Target students Division/major/grade	수학과/6학년		Opening semester	2017년 2학기
	Class time and classroom	월D(팔435) 수B(팔621)(팔435,팔621)			
Reference to this course	Related basic courses	현대대수			
	Recommended concurrent courses				
	Related advanced courses	대수학			
Instructor	Name (title/division)	박형주 (교수/수학과)			
	Office Room Number	팔달관 611	Office phone Number	3850	e-mail	alanpark@ajou.ac.kr
	Office hours		Homepage address		
Teaching Assistant	Name (title/division)				
	Office Room Number		Office phone Number		e-mail	

1. Introduction

Commutative algebra and algebraic geometry are classical subjects in mathematics, and have been studied for a long time. Computational aspects of these subjects, however, began attracting researchers' interest fairly recently. Their roots can be traced to the idea of standard bases in Hironaka's work and Gröbner bases in Buchberger's work. Similar ideas can also be found in earlier works of Janet, Shirshov and Wu.
In this course, we will study commutative algebra and algebraic geometry from computational viewpoints, and will be interested in the idea of using computers for non-numerical computations. No background in these subjects will be assumed. We will also consider extensions of these ideas to representation theory, and applications to coding theory and cryptography.
The computer algebra systems to be used in this course are Singular and Macaulay 2, which will be introduced through demonstration sessions.

2. Course Objectives

*교육목표
In this course, we will study commutative algebra and algebraic geometry from computational viewpoints, and will be interested in the idea of using computers for non-numerical computations. No background in these subjects will be assumed. We will also consider extensions of these ideas to representation theory, and applications to coding theory and cryptography.

*교과목 학습성과
The students should be ready to perform essential algebraic computations with computer algebra packages.

3. Class types and activities

In this course, we will study commutative algebra and algebraic geometry from computational viewpoints, and will be interested in the idea of using computers for non-numerical computations.

4. Teaching Method

The students should be ready to spend some time and efforts to complete the homework assignments to learn the materials presented in the classes.
The end-of-term project will give a students a chance to see the concepts in action.

5. Knowledge and ability required for taking this course

Undergraduate abstract algebra will be very helpful although it should be possible to study it in parallel.

6. Method of Evaluation

Evaluation Item	The Number of Times	Evaluation Proportion	Remarks
Attendance			
midterm exam			
final exam	1	25%	Take-home final
quiz			
presentation	1	25%	Project
discussion			
homework	4	50%	
etc			

There will be a class project. Each student will be expected to choose one topic from a given list of topics, and will make an end-of-term presentation on the topic. The topics will
include Commutative Algebra, Algebraic Geometry, Representation Theory, Coding Theory
and Cryptography. More details will be announced later.

7. Textbooks

Main/Sub	Title	Writer	Publisher	Publication year
주교재	Ideals, Varieties and Algorithms 2-nd ed.	Cox, Little and O'Shea	Springer-Verlag	1997
참고자료	Singular Reference Manual	Gruel et al		
부교재	Computational Algebraic Geometry	Hal Schenck	London Mathematical Society	2003

8. Lecture Schedule

Week	Lecture contents	Lesson type	Remark
1	Arithmetic Algorithms over Euclidean Domains		
2	Theory of Grobner Basis 1: Computations over Polynomial Rings		
3	Theory of Grobner Basis 2: Computations over Polynomial Rings		
4	Theory of Grobner Basis 3: Computations over Polynomial Rings		
5	Basics of Commutative Algebra 1		
6	Basics of Commutative Algebra 2		
7	Basics of Commutative Algebra 3		
8	Syzygies and Free Resolutions 1		
9	Syzygies and Free Resolutions 2		
10	Geometry of Points and the Hilbert Function 1		
11	Geometry of Points and the Hilbert Function 2		
12	Applications to Invariant Theory		
13	Applications to Coding Theory		
14	Applications to Cryptography		

9. Others