Homework for Math 411
Fall 2015

Textbook:
Abstract algebra, an introduction, by Thomas W. Hungerford, Third edition or Second edition

Homework for week 09/02-09/04:
Due Wednesday 09/09
09/02: Chapter 7.1, exercises 1,3,4,6 and 17 (1,3,4,11(b) and 15 in the second edition)
09/04: Chapter 7.2, exercises 2,4,6 and 7

Homework for week 09/09-09/11:
Due Monday 09/14
09/09: Chapter 7.3, exercises 4,5,7,25 in the second edition or 14,16,19,33 in the third edition
09/11: Chapter 7.4, exercises 13,15,32 in the second edition or 19,20,48 in the third edition

1st Quizz on Wednesday 09/16

Homework for week 09/14-09/18:
Due Monday 09/21
09/14: Chapter 7.4, exercise 3 (both editions)
Chapter 7.9: exercises 1,2,3 and 18 in the second edition
or Chapter 7.5: exercises 1,2,3 and 28 in the third edition
09/16: Chapter 7.9: exercises 5,6(a-c),29 and 30 in the second edition
or Chapter 7.5: exercises 7,8,29 and 30 in the third edition
09/18: Chapter 7.5: exercises 2(b-c-d) 3(d-e) and 6 in the second edition
or Chapter 8.1: 3,4,5,10,11 and 18 in the third edition

Homework for week 09/21-09/25:
Due Monday 09/28
09/21: Chapter 7.6: exercises 5,11,12 and 36 in the second edition
or Chapter 8.2: exercises 5,11,12 and 36 in the third edition
09/23: Chapter 7.7: exercises 4,10 and 20 in the second edition
or Chapter 8.3: exercises 8,13 and 30 in the third edition
09/25: Chapter 7.7: exercises 11 and 18
and Chapter 7.8: exercise 1(ade) in the second edition
or Chapter 8.3: exercises 14 and 28
and Chapter 8.4: exercises 8,10 and 14 in the third edition

2nd Quizz on Wednesday 09/30

Homework for week 09/28-10/02:
This week's homework won't be graded

09/28: Chapter 7.10: exercises 1,3 and 10 in the second edition
or Chapter 8.5: exercises 1,3 and 11 in the third edition
09/30: Chapter 8.1: exercises 3-17 in the second edition
or Chapter 9.1: exercises 3-17 in the third edition

Exercise session on Monday 10/05
We will work in class on the following exercises:
For second edition: Chapter 7.1: 14, Chapter 7.3: 33, Chapter 7.4: 26b and 31, Chapter 7.9: 25, Chapter 7.7: 22
For third edition: Chapter 7.1: 16, Chapter 7.3: 39, Chapter 7.5: 38, Chapter 7.4: 47, Chapter 7.5: 39, Chapter 8.3: 32

1st Midterm exam on Wednesday 10/07
Covers: Definition and examples of groups, subgroups, homomorphisms, symmetric and alternating groups, congruence,normal subgroups, quotient groups, simple groups, the simplicity of An

Homework for week 10/09-10/16:
Due Monday 10/19
10/09: Chapter 8.3: exercises 1 and 4 in the second edition
Chapter 9.3: exercises 1 and 4 in the third edition
10/12: Chapter 9.4 (third edition) or 8.4 (second edition): exercises 2,3 and 14
10/16: Chapter 9.5: 1,2 and 7 (third edition) or Chapter 8.5: 1,2 and 7
Hint for exercise 1: Show first if $|G|$ is the square of a prime number then $|G|$ is abelian, using Thm 8.15 and 9.27 (7.38 and 8.27 in second edition).

25 min Superquizz on Wednesday 10/14
Covers: Same material as the Midterm 1. The grade for this quizz will count instead of Midterm 1 if it is higher.

Homework for week 10/19-10/23:
Due Monday 10/26
10/19: Chapter 10.1: exercises 2,3,13 and 22 (third edition) or Chapter 9.1: 2,3,11 and 20 (second edition)
10/21: Chapter 10.1: exercises 23 and 28 and Chapter 10.2: exercises 6 and 10 (third edition)
or Chapter 9.1: exercises 21 and 26 and Chapter 9.2: exercises 6 and 10 (second edition)
10/23: Chapter 10.2: exercises 18 and 19 (third edition)
or Chapter 9.2: exercises 18 and 19 (second edition)

15 min Quizz on Wednesday 10/28
Covers: Sylow subgroup, Euclidian domains, Principal ideal domains, Unique Factorization domains.
(Chapter 8.3, 8.4, 9.1, 9.2 in the second edition, 9.3, 9.4, 10.1, 10.2 in the third)

Homework for week 10/26-10/30:
Due Monday 11/02
10/26: Chapter 10.3: exercises 2,6 and 9 (third edition) or Chapter 9.3: exercises 2,6 and 9 (second edition)
10/28: Chapter 10.3: exercises 4,14 and 19 (third edition) or Chapter 9.3: exercises 4,14 and 19 (second edition)

2nd Midterm exam on Wednesday 11/11
Covers: Sylow subgroups, Integral domains (Euclidian domains, Principal ideal domains, Unique factorization domains and the field of quotients).
List of exercises you can work on to prepare for the exam (some are new, some have been studied in homework):
3rd edition : Chap 9.3: ex 5 and 7, Chap 10.1: ex 26, Chap 10.2: ex 18, Chap 10.3: 21, Chap 10.4: ex 3 and 6
2nd edition : Chap 8.3: ex 5 and 7, Chap 9.1: ex 24, Chap 9.2: ex 18, Chap 9.3: 21, Chap 9.4: ex 3 and 6
Supplementary exercise:
Let x and y be integers solution of the equation

$$x^3 = y^2 + 1 = (y + i)(y - i)$$

1) Show that x is odd and y is even. (Hint: show that 0,1 and 4 are the only squares mod 8)
2) If δ is a common divisor of $y + i$ and $y - i$ then δ is a unit. (Hint: show that δ divides $2i$ and that $N(y + i)$ is odd)
3) Show that all units in $\mathbb{Z}[i]$ are cubes (Hint: what are the units in $\mathbb{Z}[i]$?)
4) Show that there exist a and b in $\mathbb{Z}$ such that $y + i = (a + bi)^3$.
5) Compute the imaginary part of $(a + bi)^3$ and conclude that there is no integer solution to $x^3 = y^2 + 1$ besides the trivial one: $(x = 1, y = 0)$.

Homework for week 11/09-11/20:
Due Monday 11/23
11/09: Chapter 10.5: exercises 2 and 3 (third edition) or Chapter 9.5: exercises 2 and 3 (second edition)
11/13: Chapter 10.5: exercise 11 (third edition) or Chapter 9.5: exercise 11
11/16: Chapter 11.1: exercises 3,6,9 and 22 (third edition) or Chapter 10.1: exercises 3,6,9 and 22
11/18: Chapter 11.1: exercises 23 and 39, Chapter 11.2: exercises 1,2 and 3 (third edition) Chapter 10.1: exercises 23 and 39, Chapter 10.2: exercises 1,2 and 3 (second edition)

Homework for week 11/23-11/25:

Due Monday 11/30
Chapter 10.3: exercises 2-6-7-9-12-13 (second edition)
or Chapter 11.3: exercises 2-6-7-9-12-13 (3rd edition)

4th Quizz on Wednesday 12/02
Covers: Vector spaces, simple extensions, algebraic extensions.
(Chapter 10.1 to 10.3 (2nd edition) or Chapter 11.1 to 11.3 (3rd edition))

Final on Monday 12/14
Covers: Sylow subgroups, Integral domains, Field extensions (vector spaces, simple extensions, algebraic extensions, splitting fields, normal and separable extensions)

List of exercises to prepare for the final:
Fields extensions:
Chap 11.5 (or 10.5):ex 1-2, Chap 11.4 (or 10.4): ex 1-2-3, Chap 11.3 (or 10.3): ex 11, Chap 11.2 (or 10.2): ex 18
Integral domains:
Chap 10.4 (or 9.4): ex 12, Chap 10.3 (or 9.3): ex 14, Chap 10.2 (or 9.2): ex 10, Chap 10.1: ex 26 (or Chap 9.1: ex 24)
Sylow subgroups:
Chap 9.5: ex 17 (or Chap 8.5: ex 15), Chap 9.4 (or 8.4): ex 5, Chap 9.3 (or 8.3): ex 10