Syllabus

MATH 120A LEC A: INTRO GROUP THEORY (45030)

Quarter: Winter 2009

Instructor: Chuu-Lian Terng

Textbook: A First course in abstract algebra, by John B. Fraleigh, seventh edition, Addison Wesley

We plan to cover basic theory of groups: groups, subgroups, cyclic groups, permutation groups, reflections and rotations of the complex plane, dihedral groups, orbits cycles and the alternating groups, cosets and Theorem of Lagrange, homomorphisms, factor groups, simple groups, group actions, Isomorphism Theorems, and Sylow Theorems (i.e., section 4, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 34, 36 of the textbook).

Homework will be assigned weekly and due the following Tuesday at the discussion session.

Prerequisites: Math 3A or 6G (linear algebra), and math 13 is strongly recommended.

Grading

Homework 15%, quizzes 15%, One midterm 30%, One final exam 40%.

Homework Assignments

due on Tuesday of the following week at the discussion session

Week 1 : Section 4. Groups: Ex 3, 8, 9, 10, 14, 18, 32, 34, Section 5: Ex 5, 9, 20

Week 2 : Section 5. Subgroups: Ex 13, 22, 34, 45,
Section 6. Cyclic groups: 12, 14, 18, 20, 22, 46, 55

Week 3 : Section 8. Group of permutations: Ex 2, 4, 6, 8, 16, 18, 20,
Extra credit problems:
(1) Prove that if G is a finite group of even order, then there is a in G not equal to e such that $a^2 = e$.
(2) Section 8: Ex 44

Week 4 : Section 9. Orbits, cycles, and the alternating groups: Ex 2, 8, 10, 14, 29, 34.
Extra Credit problem: Ex 39

Week 5 : Section 10. Cosets and the Theorem of Lagrange: Ex. 4, 16, 28. 29, 34, 39, 40, 44, 45.
Extra credit problem: Ex. 46

Week 6 : Section 11. Direct products and finitely generated abelian groups: Ex. 11, 14, 16, 26;
Section 13. Homomorphisms: Ex. 12, 14, 18, 44, 47, 50, 52

Week 7 : Section 14. Factor groups: Ex. 2, 6, 30, 31, 40;
Section 15. Factor groups computations and simple groups: Ex. 4,, 6, 8, 14, 36, 37.
Extra credit problems:
(1) Find all groups of order less than or equal to 6 up to isomorphisms.
(2) Find all groups of order 8 up to isomorphisms.
(3) Prove that if all non-identity element in a group G have order 2, then G is abelian.

Week 8 : Section 16. Group actions,
Section 34. Isomorphism theorems: Ex 2, 4, 8, 9;

Week 9 : Section 36. Sylow Theorems: Ex. 5, 6. 10, 13, 20.

Extra Credit problems:

(1) Prove that if a and b are relatively prime then $Z \times Z/\langle(a,b)\rangle$ is isomorphic to Z. Find a generator of $Z \times Z/\langle(a,b)\rangle$.

(2) Section 35: Ex 19