Test 1 will be in PKH 302 in class time, Thurs Feb 16

- See above for date, time and location of Test 1. It will last 30 minutes and is worth 12% of your course grade.
- The material to be covered on the test is the same as that covered on the homework and in lectures through the FIT and Section 3.2 (inclusive) in the book.
  (Homework is at my website: http://www.uta.edu/math/vancliff/T/S17/hwk5331.html .)
- My office hours are Tues & Thurs 4:40-5:20 pm in PKH 462; and the GTA has office hours on Wed 1:30-2:30 pm & Fri 11 am-noon, both in PKH 423.
- When I write a test, I look over the lecture notes and homework that have already been assigned, and any previous tests, and use them to model about 85% of the test problems (and most of them are fair game). You should expect 3-5 questions in total (i.e., 2 sides of 1 sheet of paper).
- You should know the definitions of the concepts (and examples thereof) that arise frequently in class; the theorems etc that are used frequently or which have a name; how to apply the theorems to examples and at least one method for doing each homework question. Learn any formulae taught in class. Skimming over short proofs (at most 6 or so lines) from lecture could also be helpful. You should be ready to present examples like those occurring in the homework and in lectures, and be able to show that a subset of a group is a subgroup. Moreover, any question in the homework is game for the test.
- A good way to review is to go over the homework problems you have not already done, & make sure you understand all the homework well by 48 hours prior to the test. Consider adopting one or more of the study techniques linked at my website.
- It is your responsibility to be on time.
- Try to keep your eyes on your own work during the test.
- BRING YOUR MYMAV ID CARD WITH YOU. All other nontest items will have to be put by the side walls prior to the start of the test; this includes calculators, cell phones and all electronic devices (including apple watches), which need to be switched off & in with your belongings by the wall – noncompliance will result in a score of 0 on the test.
- If you wish to leave the room during the test, you should ask permission first & turn in your test to me. Only in exceptional circumstances will I let you continue the test should you return. (So it is better to be 3 minutes late to the test, rather than ask to go to the bathroom during the test.)
- I plan to return the graded test to you on Tues Feb 21 and have a lecture as usual that day.

Groups typically arise in the world in the form of functions acting on a set or on a manifold, etc. E.g., matrices acting on a vector space, or functions that rotate and reflect a square. For this reason, groups are key players in chemistry in the study of electrons in an atom, and in the subject of robotics (as well as in many other fields).

We started the semester with definitions and examples and studied group actions, which is a topic that abstractifies the idea of functions acting on a set. In particular, the symmetric group of permutations of a set Ω yields a group action on Ω.

Subgroups were then considered, and we proved the Subgroup Criterion to help us establish when a subset of a group is a subgroup. We studied special subgroups, such as the center of a group, the centralizer of a subset of a group, the normalizer of a subset of a group, and the stabilizer of a subset of a set that is being acted on by a group.

Homomorphisms were considered briefly, and mainly (at this stage) for the goal of helping us in our discussion of cyclic groups. E.g., all finite cyclic groups of order n are isomorphic to each other and hence isomorphic to $\mathbb{Z}/n\mathbb{Z}$, and all infinite cyclic groups are isomorphic to $\mathbb{Z}$.

We briefly considered the idea of a subset of a group generating the group. This is very convenient for cyclic groups, which are generated by a single element, and also for some other groups, such as dihedral groups.

We then returned to homomorphisms and began studying their fibers. We establised that the set of fibers of a homomorphism is in fact a group, with multiplication defined appropriately. This group is called the quotient group (or the factor group, depending on the book). We met the First Isomorphism Theorem (FIT) in this context: if $\phi : G \to G'$ is a group homomorphism and if $K = \ker(\phi)$, then $G/K \cong \phi(G)$, where the factor group G/K is the group of fibers of ϕ. We also considered the idea of a coset of a subgroup, as the notion of coset generalizes the notion of fiber of a homomorphism (as each fiber is a coset of K). Trying to force the set of all cosets of a subgroup be a group (in our attempt to mimic our success with the fibers of a homomorphism) leads to the idea of a normal subgroup of a group G; that is, subgroups H such that $gH = Hg$ for all $g \in G$. Normal subgroups N of a group G can be "factored" out of G to produce a quotient group G/N. (If $|G| < \infty$, then $|G/N| = |G|/|N|$, and this is why the quotient group is denoted G/N.)

At this stage, we studied Lagrange's Theorem and Cauchy's Theorem, which apply to finite groups. Lagrange's Theorem tells us that the order of any subgroup of a finite group G divides the order of G. Cauchy's Theorem tells us that if G is a finite group with order a multiple of a prime number, p, then G contains an element of order p (and therefore contains at least one subgroup of order p (the cyclic group generated by any element of order p)). Although our textbook does not prove Cauchy's Theorem at this stage, we discussed a proof of it that is outlined in one of the exercises in the book (pg 96: 9).