

**Math 301      Objectives and Skills covered for Test 2      04/08/02**

Test 2 will be a take-home exam distributed on Friday, April 12, in class, due Monday, April 15, in class.

The exam will cover the second third of chapter 2 plus some material from chapter 3.

The rules and the format will be pretty much the same as in the first midterm exam.

More precisely, the material covered is as follows:

- Equivalence relations, cosets and Lagrange's Theorem (section 2.4)
- Group homomorphisms (section 2.5)
- Normal subgroups (section 2.5)
- Factor groups and Cauchy's theorem for abelian groups (section 2.6)
- Homomorphism theorems (section 2.7) (this is more for the final, though)
- Material on the symmetric group from Chapter 3: The sign of a permutation, even/odd permutations, the alternating group, cycle notation, cycle decomposition of a permutation.
- Modulo arithmetic: groups  $\mathbb{Z}_n$  and  $U_n$ , properties of the gcd (greatest common divisor) (part of sections 2.4 and 1.5)

Computational skills:

- Given some map between groups,
  - check whether it is a homomorphism
  - if so, calculate its image and kernel
- Given a group with a subgroup,
  - check whether the subgroup is normal
  - if so, perform multiplication in the factor group
- Given some permutation,
  - find its sign and order
  - find its cycle decomposition
- Modulo arithmetic in  $\mathbb{Z}_n, U_n$ 
  - Given two integers  $a, b$ ,
    - \* find the greatest common divisor  $d$  of  $a, b$
    - \* find integers  $x, y$  such that  $d = ax + by$  (extended Euclidean algorithm)