FINAL EXAM INFO – MATH 311W

EXAM ON MONDAY DECEMBER 17TH, 8:00AM-9:50AM

1. There will be two pages of short answer questions. For example, I could ask you about the well ordering principal or to prove something short via induction. I could ask you to state the Chinese Remainder Theorem, or to solve a system of congruences in a simple case. I could ask you about Fermat's little theorem or Euler's theorem. I could ask you to define or give an example of injective or surjective functions, or symmetric etc. relations. I could ask you to do some simple computations with permutations, or to define what a cycle is, or what an even or odd permutation is. I could ask you to define a group, to define what a cycle group is (or give an example of a group that is or is not cyclic). I could ask you about the order of a group.

2. There will be one page of computations. This could include everything from equivalence classes mod n, to finding solutions via the Chinese remainder theorem, to applying the Euclidean algorithm, to functions and relations, to permutations, to cosets, to groups.

3. There will be one proof question which I will tell you nothing about.

4. I will then ask you to prove two of the following theorems.

(a) The existence of gcds, Theorem 1.1.2 in the text.
(b) Prove that the well ordering principle implies that principle of mathematical induction, Theorem 1.2.2 in the text.
(c) Prove the fundamental theorem of arithmetic (unique factorization of integers), Theorem 1.3.3 in the text.
(d) Suppose that R is an equivalence relation on a set X. Prove that R determines a partition of X whose blocks are the equivalence classes of R (page 114 in the text).
(e) Suppose that τ and σ are disjoint permutations in S_n. Prove that $\tau\sigma = \sigma\tau$ (page 153 in the text).
(f) Prove that if α and β are permutations, then $\text{sign}(\alpha\beta) = \text{sign}(\alpha)\text{sign}(\beta)$
(g) State and prove Lagrange's theorem.
(h) State and prove the Chinese Remainder Theorem.
(i) Prove Euler's theorem using Lagrange's theorem.

EC. There will be one extra credit problem.