General Information, Format and Groundrules

The first midterm exam will be given Monday evening October 1. This will be an *closed book* exam. It will start at 7:00pm, and you will have until 9:00pm to work on it. The exam will be written so that if you are well prepared and work steadily, you should take about 1 hour to complete it, but you will have the extra time to eliminate any time pressure.

Topics

The exam will cover the material we have discussed since the beginning of the semester, up to and including the material on the irreducible polynomials in $\mathbf{R}[x]$ and $\mathbf{C}[x]$ from class on Monday, September 24. This is the material from Chapters 3 and 4 in Hungerford.
The exam will focus mainly on the key definitions and theorems we have studied. There will also be a few problems or parts of problems where you will need to apply some of those definitions and theorems to new situations.

The topics to be covered are:

1) The definition of a ring and key examples.
2) Basic properties of rings.
3) Isomorphisms and homomorphisms.
4) Polynomial rings, the division algorithm and consequences.
5) Divisibility in $F[x]$.
6) Irreducible polynomials and unique factorization.
7) Roots of polynomials and factorizations.
8) Results on irreducibility of polynomials in $\mathbf{Q}[x]$, $\mathbf{R}[x]$, $\mathbf{C}[x]$.

Review Session

We will review for the exam in class on Monday, October 1. Of course this means you will not have much time between then and the exam to do further preparation. *Begin your studying before the review session, please!*

Key Theorems and Proofs to Know

1) Know how to show that a given subset of a ring R is, or is not, a subring of R. (Note: in most cases, the criterion of Theorem 3.6 in Hungerford is the "preferred method.")
2) Know how to show that a given mapping $\varphi : R \to S$ is, or is not, a homomorphism of rings. Same for isomorphisms.

3) Know how to prove the uniqueness of the quotient and the remainder in polynomial division, given the existence.
4) Know the statement and proof of the Unique Factorization Theorem in $F[x]$ (see Theorem 4.13 in Hungerford, and the class notes).
5) Know how to prove that $a \in F$ is a root of $f \in F[x]$ if and only if $(x - a)|f$.
6) Know the statement and the proof of the Rational Root Test (Theorem 4.20 in Hungerford and the class notes).
7) Know the statement and proof of Eisenstein's Irreducibility Criterion in $\mathbf{Q}[x]$ (see Theorem 4.23 in Hungerford, and the slightly different proof in the class notes).

Suggested Review Problems

From Hungerford:
3.1/5, 19, 38;
3.2/13, 14, 15, 21 (read page 59 first!), 26;
3.3/13, 16, 18, 31;
4.1/5bd, 6, 19;
4.2/7, 8, 10;
4.3/7, 10, 12, 13, 25, 26;
4.4/3, 14, 17;
4.5/1bd, 10, 16, 17, 18.
4.6/2, 3, 6.