

Math 104A Syllabus

This is a description of topics through November 26.

1. Commutative rings with unit.
 2. Ordered and well ordered rings.
 3. The natural numbers.
 4. Mathematical Induction.
- 1.-4. are the topics in Supplement 1. The references given as page numbers will be to the text (Rose).
5. The division algorithm and long division p.2
 6. The Euclidean algorithm to calculate GCD pp.2-4.
 7. Integral solutions to the equation $ax + by = c$ pp.4-5.
 8. Unique factorization pp. 7-8.
 9. Congruence modulo m and the ring $\mathbb{Z}/m\mathbb{Z}$ pp.7-8.
 10. The Euler ϕ function and the Euler and Fermat theorems p.35,pp.39,40.
 11. The Chinese Remainder Theorem p.37 and p.38 first paragraph.
 12. Modular arithmetic and RSA section 3.4.
 13. Integers to base other than 10 Supplement 2..
 14. Polynomials with coefficients in rings.
 15. Euclidean algorithm for polynomials over a field.
 16. The number of roots of a polynomial of degree n in $F[t]$ with F in F is at most n .
 17. The order of a non-zero element in a field. Primitive element in $F_p - \{0\}$. Topics 15-17 are in Supplement 3.
 18. The Legendre symbol $\left(\frac{a}{p}\right)$ with p an odd prime and $a \in \mathbb{Z}$. pp.58-62.
 19. Euler's formula for $\left(\frac{a}{p}\right)$.
 20. Wilson's necessary and sufficient condition for primality.
- 19,20 are in Supplement 3.
21. Permutations and their signs.
 22. A definition of the Legendre symbol using the sign of a permutation.
 23. Calculation of $\left(\frac{2}{p}\right)$ as a sign of a permutation.
- 21-23 are in Supplement 4.
24. The Jacobi symbol. Supplement 4 and pp.70-72.
 25. A direct proof of Jacobi reciprocity. Supplement 4.
 26. Jacobi reciprocity as an efficient way of calculating Legendre symbols.
- Supplement 4.
27. Multiplicative arithmetic functions, examples pp. 17-18.
 28. Mobius inversion pp.19-23.