DISCRETE MATHEMATICS
Math 245
Michael E. O'Sullivan

Suggestions for preparing for the Fourth Exam

(*) indicates level 2 problems.

I. Sequences and recursion.

- Be able to use summation and product notation.

- Be able to use recursive formulas.

- Find the first several terms of a sequence given the inital terms and the recurrence formula.

- Check that a sequence that is given explicitly satisfies a recurrence formula.

II. Know the formulas for the following sums:

- The sum of a geometric sequence. For any real $r \neq 1$, and for any $n \in \mathbb{N}_0$, $\sum_{i=0}^{n} r^i = \frac{r^{n+1}-1}{r-1}$.

- The sum of the first n integers. For any integer $n \geq 1$, $\sum_{i=1}^{n} = \frac{n(n+1)}{2}$.

III. Know how to prove by induction!

- To write an induction proof:

  – Use full sentences.
  – State the predicate.
  – Prove the base step.
  – State the assumption for the inductive step.
  – Do the inductive step.

- For level 1:

  – I will guide you through the proof.
  – There are three types of proofs.
    Proving the nth element of a sequence is equal to some formula involving n
    (§5.2 #10-16).
    Proving an inequality (§5.3 #8-15).
    Proving a divisiblility result (§5.3 #16-20).

- * For level 2:

  – You should be able to write the proof yourself.
  – Be able to use strong induction (§5.4 #1-6).