

# DISCRETE MATHEMATICS

## Math 245

Michael E. O'Sullivan

### Suggestions for preparing for the Third Exam

#### I. Functions and relations.

- Know the definitions!
  - Relation, inverse of a relation.
  - Function. Injective (one-to-one), surjective (onto) and bijective functions.
- Use a list of elements, an arrow diagram, a table, a graph, or a formula to define a function or relation.
- Determine whether a given relation is a function, or whether a given function is injective or surjective.
- Find the inverse relation of a function. Is it a function, injective, surjective?
- Give examples of functions satisfying various properties (see 7.2 #9 3rd Ed., 7.3 #5 2nd Ed.).
- Be able to compute the composition of two functions. See also problems §7.4 #16-19 3rd Ed., §7.5 #15-18 2nd Ed.

#### III. Relations on a set.

- Know the definitions!
  - Reflexive, symmetric, transitive.
  - Equivalence relation, equivalence class.
  - Partial order. Comparable, total order, maximal, minimal, least, greatest.
- Verify or prove that a given relation  $R$  is symmetric.
- Ditto for reflexive, transitive, equivalence relation, partial order.
- Ditto for irreflexive, antisymmetric, asymmetric (but I will give you the definition).
- Use arrow diagrams, tables, graphs and lists of elements to represent a relation.
- For a relation  $R$  on  $A$ , be able to find the smallest relation containing  $R$  which is symmetric (ditto for reflexive, transitive, an equivalence relation, a partial order).
- Know the standard examples of equivalence relations (mod  $n$ , 10.3.10 and exercises 10.3 #18, 19, 22, 23 3rd Ed., 10.3 #15, 16, 19, 20 2nd Ed.).
- Know the standard examples of partially ordered sets:  $\leq$  for the integers (or rationals) divides on the integers;  $\mathcal{P}(A)$  for a set  $A$ ;  $D_n$ ; (10.5 #16, 17, 18, 19, 20, 21 both Eds.).
- Draw Hasse diagrams for a poset. Find minimal and maximal elements of a poset.

III. Counting, §6.2,3 only.

- The number of elements of a Cartesian product “the multiplication rule”).
- The number of elements of a disjoint union of sets.
- The inclusion-exclusion formulas.