Math 311
Exam 2 Review Sheet

Section 9.1 - Relations and Their Properties

• Know the definition of an binary relation and how it is represented as a set of ordered pairs.
• Understand what it means for a relation to be reflexive, irreflexive, symmetric, antisymmetric, or transitive.
• Be able to determine whether a given relation on a set is reflexive, irreflexive, symmetric, antisymmetric, or transitive.
• Be able to combine relations to form new ones using union, intersection, complementation, difference, symmetric difference, and composition.

Section 9.3 Representing Relations

• Given a specific relation, be able to represent it using a matrix and be able to represent is using a directed graph.
• Given a matrix or a directed graph, be able to list the ordered pairs in the relation represented by the matrix (or directed graph).
• Be able to recognize whether a relation on a set is reflexive, irreflexive, symmetric, antisymmetric, or transitive by looking at its matrix.
• Be able to recognize whether a relation on a set is reflexive, irreflexive, symmetric, antisymmetric, or transitive by looking at its directed graph.
• Be able to apply the operations union, intersection, complementation, difference, symmetric difference, and composition to matrices of relations and to directed graphs of relations.

Section 9.5: Equivalence Relations

• Know the definition of an equivalence relation and be able to prove whether a given relation is an equivalence relation.
• Understand the definition of the equivalence class of an element with respect to an equivalence relations on a set A and be able to find the equivalence class of a given element.
• Understand the relationship between equivalence classes and partitions of the underlying set. Be also to tell whether or not a given family of subsets is a partition, and if so, be able find the equivalence relation described by the partition.
• Given a directed graph or a matrix, be able to determine whether the associated binary relation is an equivalence relation.

Section 9.6: Partial Orderings

• Know the definition of a partial order and be able to prove whether a given relation is a partial order.
• Understand the definition of comparable and incomparable elements, and be able to determine whether a given pair of elements are comparable or incomparable with respect to a particular partial order.
• Understand definition of a total ordered set and a well ordered set.
• Understand the lexicographic order, and be able to order a given pair of elements with respect to this ordering.
• Be able to draw the Hasse diagram for a poset. Also be able to read off the ordered pairs in a partial order from its Hasse diagram.
• Understand the definition of maximal elements, minimal elements, greatest elements, least elements, upper bounds, lower bounds, least upper bounds, and greatest lower bounds. Also be able to find these (when they exist) in a given poset.

Section 10.7: Planar Graphs

• Understand the definition of a planar representation of a graph and be able to find a planar representation for a graph (when one exists).
• Memorize Euler's Formula, know the definition of a region in a planar representation of a graph, and be able to verify that Euler's Formula holds for a given planar graph.
• Know the corollaries to Euler's Formula and be able to use them to show that a graph is not planar.
• Know and be able to apply Kuratowski's Theorem.

Section 12.1 and 12.2: Boolean Functions and Boolean Algebras

• Understand Boolean Operations, Boolean Expressions, and be able to compute the value of a Boolean expression.
• Understand Boolean functions and know the Boolean identities.
• Know the abstract definition of a Boolean Algebra and be able to prove that a Boolean Identity holds directly from the definition.
• Be able to find the sum-of-products representation of a function. Also understand how to verify that a set of Boolean operations is functionally complete and be able to rewrite expressions in terms of a given set of operations.