Review

The document `http://faculty.uml.edu/jpropp/2190/words.pdf` ("Some words about words") contains information about math-language that I find it helpful to tell my Discrete Structures I students at the start of the semester. You should review this material at the start of the term, especially if you're shaky about the correct answer to questions like "Is 0 even?" and "Is 1 prime?"

Additionally, here is some information from Discrete Structures I that you might want to be reminded about. If later in the term you find that there are gaps in your recollection that you wish this document had filled, please let me know, and I'll include them in future versions of this document.

1. **Ordered pairs, unordered pairs, sets** (chapter 1)

The ordered pair $(2,3)$ is not the same as the ordered pair $(3,2)$. However, the unordered pair $\{2,3\}$ *is* the same as the unordered pair $\{3,2\}$. $\{2,3\}$ is what mathematicians call a *set* of numbers, and you are expected to recall the material from chapter 1.

In chapter 9, we use ordered pairs (i,j) for directed edges of graphs, since a directed edge pointing from vertex i to vertex j is different from a directed edge pointing from vertex j to vertex i, but we use unordered pairs $\{i,j\}$ for undirected edges of graphs, since an undirected edge joining vertex i with vertex j is the same as a directed edge joining vertex j with vertex i. Please don't write (i,j) when you mean $\{i,j\}$ or vice versa.

(Speaking of graph theory: Please note that "vertexes" and "vertice" are not correct words; the singular is "vertex" and the plural is "vertices".)

Also: The number 0 is not the same as the set $\emptyset$. The former is not a set; the latter is a set that happens to contain no elements (sometimes it's written as $\{\,\}$). Please don't write 0 when you mean $\emptyset$ or vice versa.

2. **Logic** (chapter 3)

"P if Q", "P only if Q", and "P iff Q" all mean different things; we represent them by $P \leftarrow Q$, $P \rightarrow Q$, and $P \leftrightarrow Q$, respectively. Another way to say $P \rightarrow Q$ is "P is a sufficient condition for Q". Likewise, another way to say $P \leftarrow Q$ is "P is a necessary condition for Q".

And then there's the phrase "if and only if" (used in section 9.2, for instance), often abbreviated to "iff": we write "P iff Q" when P and Q both imply each other. In that case, we say that P is a necessary and sufficient condition for Q.

$(\forall x)_A\, p(x)$ means "For all x belonging to A, the proposition $p(x)$ is true"; it is regarded as being vacuously true when A is empty. $(\exists x)_A\, p(x)$ means "There exists an x belonging to A for which $p(x)$ is true."

3. **Matrix algebra** (chapter 5)

You're expected to know how to add and multiply matrices. (Note that "matrixes" and "matrice" are not correct words; the singular is "matrix" and the plural is "matrices".) We need matrix multiplication in section 9.3.

4. **Functions** (chapter 7)

Other words for functions are *map* and *mapping*. When f is a function (which we also call a mapping or a map) from a set A to a set B, with a in A and b in B satisfying $f(a) = b$, we often say that f "sends" a to b, or "carries" a to b, or "maps" a to b.

For instance, a graph coloring is defined in section 9.6 as a function from the set of vertices of a graph to some pre-chosen set of colors.

Suppose f is a function from the set A to the set B. If for every b in B there is *at least one* a in A such that $f(a) = b$, we say f is onto, or surjective. If for every b in B there is *at most one* a in A such that $f(a) = b$, we say f is one-to-one, or injective. A function that is both surjective and injective is bijective.

The identity function from A to A is the function i satisfying $i(a) = a$ for all $a \in A$. It is bijective.

5. **Propositions and sets** (chapters 3 and 4)

A major theme of Discrete Structures I is the correspondence between set theory and propositional logic. Sets come up all over the place in Discrete Structures II as well.

6. **Partitions** (chapter 2)

The concept of partitions (from section 2.3) plays a role in many places in Discrete II, including the discussion of connected components in Chapter 9.

7. **Relations, posets and equivalence relations** (chapter 6)

Understanding 9.1.23 requires recalling how relations are depicted by way of directed graphs.

The concept of partially ordered sets from section 6.3 gets revisited in a big way in Discrete II when we study lattices and Boolean algebras in chapter 13. In particular, review Definition 6.1.5: If a and b are integers with $a \neq 0$, we say that a divides b (denoted $a|b$) if and only if there exists an integer k such that $ak = b$. Also, a big theme of Discrete II is isomorphism, and inasmuch as the relation "is-isomorphic-to" is reflexive, symmetric, and transitive, a review of equivalence relations would be helpful.

8. **Other things**

If you encounter mathematical words you don't remember from Discrete Structures I, use Doerr and Levasseur's index (or, if you're viewing the PDF version of the book, use your viewer's Find command). Likewise, if you encounter mathematical symbols you don't remember from Discrete Structures I, use Appendix E ("Notation") from the textbook.