The exam will include definitions, some other short-answer questions such as true-false or answering a question about a given graph, and some proofs. I won’t ask you to give proofs of theorems proved in the textbook, but you should be able to use the techniques used in those proofs. The homework is a good general guide to the kind of problems you’ll see, though some of the homework problems are probably too long for an in-class exam. So make sure you have gone through the posted solutions to homework problems. For proofs, you can use results from the book, homework problems, or discussion in class, but you need to cite those results. You don’t need to cite theorems by the number in the book, but you should say “A theorem in the book says that . . . ” or something like that which makes it clear exactly what result your referring to.

You’ll have the whole class period (but people who come late won’t get extra time without a very good reason). No notes, books, or electronic devices can be used during the exam.

The exam will cover the material through Section 1.3.3 (except for section 1.2.3), plus the statement of Cayley’s formula. You’re responsible for the material in the textbook and everything we’ve done in class. Here’s a bit more detail on the topics (though the fact that something is listed here doesn’t mean it will necessarily be on the exam and the fact that something isn’t mentioned here doesn’t mean it won’t be on the exam).

Section 1.1: You need to know the basic definitions of graphs (remember that we’re focusing on finite simple graphs), order, size, degree, neighborhood, etc. You need to know the differences between walks, paths, cycles, and trails, and how they’re related (e.g., the theorem that every $u-v$ walk contains a $u-v$ path). Walks (or paths) are used to define connected graphs and connected components of a graph.

You need to be able to work with the basic operations of deleting vertices and edges. These operations are related to vertex cut sets and the connectedness of a graph, and to bridges. We have proved various results relating things like number of edges, minimum degree, and existence of cycles to connectedness.

You should understand the ideas of subgraphs and induced subgraphs. You should be able to work with the idea of isomorphisms of graphs.

You also need to know some of the special types of graphs we’ve looked at, such as $P_n$, $C_n$, and $K_n$. You also need to know about bipartite graphs (and complete bipartite graphs) and regular graphs and the properties of these graphs that we’ve discussed.

Section 1.2: This section is focused on distance in a graph. You obviously have to know the basic definition of the distance between two vertices (as the length of the shortest path between them) and its basic properties (such as the triangle inequality). We used distance to define the eccentricity of a vertex
and the radius and diameter of a graph, and we proved some relations between radius and diameter. We defined the center and periphery of a graph, showed that every graph is isomorphic to the center of some graph, and gave conditions for a graph to be isomorphic to the periphery of some graph.

You need to know about the adjacency matrix of a graph and how the powers of the adjacency matrix count the numbers of walks of given length between vertices. And you should be able to use the matrices $S_r = I + A + \cdots + A^r$ to compute the eccentricity of a vertex or the radius and diameter of a graph, as well as to define the distance matrix of the graph.

**Section 1.3** You need to know the definition and basic properties of trees (e.g., a tree of order $n$ has $n - 1$ edges, at least two leaves, a center of order 1 or 2). You should know the theorem that says that, if $\delta(G) \geq k$, any tree of size $k$ is isomorphic to a subgraph of $G$.

You should know what a weighted graph is, what a minimum weight spanning tree is, and Kruskal’s and Prim’s algorithms for finding minimum weight spanning trees. You should know Cayley’s formula, though I won’t ask you to prove it, but there won’t be any questions about the Matrix Tree Theorem.