Sergio E. Garcia Tapia
Algorithms by Sedgewick and Wayne (4th edition) [SW11]
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4.1: Undirected Graphs

Exercise 1. What is the maximum number of edges in a graph with V vertices and no parallel edges? What is the minimum number of edges in a graph with V vertices, none of which are isolated (have degree 0)?

Solution. No parallel edges means that at most one edge connects any two given nodes. For any vertex v_i, there are V possible edge candidates, including v_0 itself (because loops are not disallowed, we can assume they are allowed). Then, for v_1, there are $V - 1$ edges allowed: one for v_1, and one for each other vertex, except v_0. Continuing this way, we find that there is a maximum of $V!$ (V factorial) edges.

If V is even, then the minimum is $V/2$, since we can pair all vertices. If V is odd, it is $\lfloor V/2 \rfloor + 1$.

Exercise 2.

Exercise 3. Create a copy constructor for `Graph` that takes as input a graph `G` and creates and initializes a new copy of the graph. Any changes a client makes to `G` should not affect the newly created graph.

Solution. See `com.segarciat.algs4.ch4.sec1.ex03`.

Exercise 4. Add a method `hasEdge()` to `Graph` which takes two `int` arguments `v` and `w` and returns `true` if the graph has an edge `v-w`, `false` otherwise.

Solution. See `com.segarciat.algs4.ch4.sec1.ex04`.

Exercise 5. Modify `Graph` to disallow parallel edges and self-loops.

Solution. See `com.segarciat.algs4.ch4.sec1.ex05`.

References

[SW11] Robert Sedgewick and Kevin Wayne. *Algorithms*. 4th ed. Addison-Wesley, 2011. ISBN: 9780321573513.