Disclaimers: If a definition, term, or notation was discussed in class and/or appeared on the homework, you are expected to know it. There is no claim that this review is perfect.

Chapter 4: Planar Graphs

- terms: plane graph, face, outer face, outer planar, maximally planar, plane triangulation, maximal plane graph.
- theorems to remember:
  - Thm 4.4.1 Jordan Curve theorem
  - Prop 4.2.4: A plane forest has exactly one face.
  - Prop 4.2.6: In a 2-connected plane graph, every face is bounded by a cycle.
  - Prop 4.2.8 A plane graph on at least three vertices is maximally plane if and only if it is a plane triangulation.
  - Cor 4.2.10 A plane graph has at most $3n-6$ edges (provided $n \geq 3$). Every plane triangulation with n vertices has exactly $3n-6$ edges.
  - Cor 4.2.11 A plane graph contains neither a K^5 nor a $K_{3,3}$ as a subgraph.
  - Prop 4.4.1 Every maximal plane graph is maximally planar. For a planar graph, maximally planar is equivalent to having $3n-6$ edges (provided $n \geq 2$).
- theorems to know by name: Thm 4.2.9 Euler's Formula, Thm 4.4.6 Kuratowski's Theorem A graph is planar if and only if it has no K^5 or $K_{3,3}$ minor.

Chapter 5: Coloring

- terms: coloring, vertex coloring, edge coloring, k-coloring, k-edge-coloring, k colorable, k-edge colorable, k-chromatic, k-edge-chromatic, chromatic number, edge chromatic number, $\chi(G)$, $\chi'(g)$, greedy coloring, Mycielski's construction
- theorems to remember:
  - Lemma 5.2.3 Every k-chromatic graph contains a subgraph of minimum degree at least $k-1$.
  - Prop 5.3.1 If G is bipartite, then $\chi'(G) = \Delta(G)$.
- theorems to know by name:
  - Them 5.2.4 Brook's Theorem Let G be a connected graph. Then $\chi(G) \leq \Delta(G)$ or G is a complete graph or G is an odd cycle.
  - Thm 5.3.2 Vizing's Theorem For every (simple) graph G, $\Delta(G) \leq \chi'(G) \leq \Delta(G)+1$.

Chapter 6: Flows

- terms: network, capacity, flow, integral flow $\overrightarrow{E}(G)$, cut, $\overrightarrow{E}(X,Y)$ $\overrightarrow{e}$, $\overleftarrow{e}$, $c(X,Y)$, $f(X,Y)$, value of a flow, $|f|$, capacity of a cut.
- theorems to remember:

  - Prop 6.2.1: In a network N with cut S, $f(S,\overline{S}) = f(s,V)$.

- theorems to know by name: Thm 6.2.2 Ford Fulkerson In every network, the maximum value of a flow is equal to the minimum capacity of a cut.

Chapter 7: Extremal Graph Theory

- terms: Turán graph, extremal graph, extremal number, $ex(n,H)$
- theorems to know by name: Thm 7.1.1 Turán For all integers r and n with $r > 1$, if G is K^r-free and $|E(G)| = ex(n,K^r)$, then $G \cong T^{r-1}(n)$.