Contents

1 Coloring

Vertex Coloring

Theorem 1.1 (Brook's Theorem)**.** *In a connected graph in which every vertex has at most Δ neighbors, the vertices can be colored with only Δ colors, except for two cases, complete graphs and cycle graphs of odd length, which require $\Delta + 1$ colors.*

1.0.1 Chromatic Polynomial

$$P_G(k) = P_{G_1}(k) + P_{G_2}(k)$$

The first coefficient is always 1.

The degree of the first term is the ($|V|$).

The second coefficient is always $-(|E|)$.

The final (constant) coefficient is always 0.

Definition 1.2. The chromatic polynomial of a complete graph K_n on n vertices is

$$P_{K_n} = k(k-1)(k-2)...(k-(n-1))$$

◇

Definition 1.3. The chromatic polynomial of a tree T_n on n vertices is

$$P_{T_n} = k(k-1)^{n-1}$$

◇

Edge Coloring

Definition 1.4. The chromatic index of a graph, χ', is ... ◇

number of edges in $L(G) = \sum_{i=1}^{n} \binom{d_i}{2}$

Theorem 1.5. $\chi'(G) = \chi(L(G))$

Theorem 1.6 (Vizing's Theorem)**.** *The chromatic index of simple undirected graph is either Δ or $\Delta + 1$.*

Theorem 1.7 (König's Line Coloring Theorem)**.**

Continued line graph derivations of connected graphs

1. Paths
2. Cycles
3. $K_{1,3}$
4. All others grow

Theorem 1.8 (Whitney's Theorem)**.** *Two connected graphs on at least 4 vertices are isomorphic if and only if their line graphs are isomorphic.*

2 The Next Section

Hello this is another section.