Definition

The best way to understand the terms is to give an example for each term.

1. Acyclic, Forest, and Tree

   - A graph is **acyclic** if it has no cycles.
   - A **forest** is an acyclic graph.
   - A **tree** is an acyclic connected graph.

2. Independent set and Independence Number

   $G = (V, E)$ is a graph. $S \subseteq V$.

   - If no two distinct vertices in S of which are adjacent, then S is an **independent set** or **stable set**.
   - If S^* is a maximum independent set for G, then $\mid S^* \mid$ is called **independence number** of G, written $\beta(G)$

3. Class 1 and Class 2

   - A simple graph G is **Class** 1 if $\chi'(G) = \Delta(G)$.
   - A simple graph G is **Class** 2 if $\chi'(G) = \Delta(G) + 1$.

4. Edge labeling, k-edge-coloring, Proper, k-edge-colorable and Chromatic index

   - An **edge labeling** is a function mapping E to a set of labels.
   - A **k-edge-coloring** is a function mapping E to a k-set $\{1, 2, \ldots, k\}$ of labels. The labels $1, 2, \ldots, k$ is called **color**. A subset assigned to the same color is called a **color class**.
   - A k-edge-coloring of a graph is almost always a **proper** coloring, namely a labelling of the edges with colors such that no two edges sharing the same vertex have the same color.
   - The smallest number of colors needed for an edge-coloring of a graph G is the **chromatic index**, or edge chromatic number, $\chi'(G)$.

5. Random graph Model

   Different random graph models produce different probability distributions on graphs.

   - Most commonly studied is the one proposed by Edgar Gilbert, denoted $G(n, p)$, in which every possible edge occurs independently with probability $0 < p < 1$. The probability of obtaining any one particular random graph with m edges is $p^m(1-p)^{N-m}$ with the notation $N = \binom{n}{2}$.

6. Dominating set

   A set V is a **dominating set** of a graph $G = (V, E)$ if each vertex in V is either in S or is adjacent to a vertex in S. And the **dominating number** $\gamma(G)$ is the minimum cardinality of a dominating set of G.

7. Factor

   Given a graph (nultigraph, general graph) G, we say that H is a **factor** of G if H is a spanning subgraph of G. A factor that is k-regular is called a k**-factor**.

8. Tur$\acute{a}$n graph

   Let $n \geq r \geq 2$ be integers. The **Tur$\acute{a}$n graph** $T_r(n)$ is the complete r-partite graph whose partite sets are of nearly equal sizes. By the other way, if $n = rs + t$ $(0 \leq t \leq r-1)$, then $T_r(n)$ has t partite sets of cardinality $\lceil n/r \rceil$ and $r - t$ partite sets of cardinality $\lfloor n/r \rfloor$.

9. Extremal graph and Forbidden graph

   Let $\{F_n\}_{n=1}^{\infty}$ be a sequence of families of graphs, and let $\Phi(n, F_n)$ be the set of graphs $G(n)$ that are H-free for every $H \in F_n$.

   - The function $ex(n, F_n)$ of n is called the **extremal function** of the sequence $\{F_n\}$.
   - The graphs $G \in \Phi(n, F_n)$ for which $e(G) = ex(n, F_n)$ are called **extremal graphs**.
   - In this context, the families $\{F_n\}_{n=1}^{\infty}$ are called **forbidden graphs**.

10. Crossing Number

    The **crossing number** $cr(G)$ of a graph G is the lowest number of edge crossings of a plane drawing of the graph G.