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*Kelly-Type Subgraph Counting Identities and Clique Polynomials*

Subgraph counting identities play an essential role in reconstruction problems for graphs. Vertex and Edge - Kelly Lemmas are two key lemmas in the theory of graph reconstructions. The clique polynomial of a graph  $G$  is the polynomial  $C(G, x) := 1 + \sum_{\emptyset \neq U \subseteq V(G)} x^{|U|}$ , where the sum runs over all induced subgraphs  $G[U]$  that are cliques in  $G$ .

In this talk while reviewing Kelly's subgraph counting lemmas, we will obtain other Kelly - type subgraph counting identities. We will also give several new graph - theoretical interpretations of the first and higher order derivatives of the clique polynomial of a finite simple graph. Finally, we will use the above new interpretations along with the interlacing theory of polynomials to provide some bounds on the number of the real roots of the clique polynomials of several important classes of graphs, including chordal and planar graphs.