Marked Graphs, marked polynomials and relationships with chromatic symmetric functions and W-polynomials

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We will introduce marked graphs and marked graph polynomials. A marked graph is a graph where each vertex is annotated with two numbers: a weight to keep track of the original number of vertices, and a number of dots, to keep track of the contractions taken in order to create this vertex from the original graph. Marked graph polynomials are polynomials that satisfy a marked deletion-contraction property and a new property called dot-removal formula. This dot removal formula + the marked deletion-contraction allows us to encode 4T relations of chromatic symmetric functions into these polynomials and hence understanding these new polynomials allows us for a better understanding of the chromatic symmetric function.