Cohen-Lenstra in the Presence of Roots of Unity

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The class group is a natural abelian group one can associate to a number field, and it is natural to ask how it varies in families. Cohen and Lenstra famously proposed a model for families of quadratic fields based on random matrices of large rank, and this was later generalized by Cohen-Martinet. However, their model was observed by Malle to have issues when the base field contains roots of unity. We study this in detail in the case of function fields using methods of Ellenberg-Venkatesh-Westerland, and based on this we propose a model in the number field setting. Our conjecture is based on keeping track not only of the underlying group structure, but also certain natural pairings one can define in the presence of roots of unity (joint with Lipnowski, Sawin).