Limiting spectral distribution of large dimensional random matrices:
Another look at the moment method

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Methods to establish the limiting spectral distribution (LSD) of large dimensional random matrices include the moment method which invokes the trace formula. Its success has been demonstrated in several types of matrices such as the Wigner matrix and the sample variance covariance matrix. In a recent article Bryc, Dembo and Jiang (2006) establish the LSD for random Toeplitz and Hankel matrices using the moment method. They perform the necessary counting of terms in the trace by splitting the relevant sets into equivalence classes and relating the limits of the counts to certain volume calculations.

We develop this method further and provide a general framework to deal with symmetric patterned matrices with entries coming from an independent sequence. This approach can be extended to cover matrices of the form $A_p = \frac{1}{n}XX'$ where X is a $p \times n$ matrix with $p \to \infty$ and $n = n(p) \to \infty$ and $p/n \to y$ with $0 \leq y < \infty$. The method can also be used to cover some situations where the "input" sequence is a suitable linear process. Several new classes of limit distributions arise and many interesting questions remain to be answered.