1003-05-330 **Nicholas M. Ercolani**, **Kenneth T.-R. McLaughlin** and **Virgil Pierce***
(`vpierce@brandeis.edu`), Brandeis University, Department of Mathematics, PO Box 9110,
Waltham, MA 02454. *Random Matrices, Graphical Enumeration and the Continuum Limit of Toda Lattices II.*

We have been considering the large N expansion of a random matrix partition function which describes the expectations of matrix observables with respect to a conjugation-invariant gaussian measure on the given ensemble of matrices. Here the ensemble is the space of N x N Hermetian matrices.

Our particular interest is in the expectation of the exponential of a general power of a random matrix in the Hermetian Ensemble. The leading order term in the large N expansion of this expectation is an analytic function of the coupling parameter between the Gaussian measure and the exponential observable.

The Taylor Coefficients of this leading order term enumerate genus zero (planar) maps with vertices of a fixed degree given by the matrix power being considered.

The leading order term of this asymptotic expansion is explicitly expressed through the equilibrium measure. The equilibrium measure is found in terms of the generating function of the Higher Catalan Numbers. This computation is then used to derive a closed form expression for the Taylor Coefficients at the leading order. (Received October 04, 2004)