Submitted to the Annals of Applied Probability

MULTIPLICATIVE FREE CONVOLUTION AND INFORMATION-PLUS-NOISE TYPE MATRICES

By Øyvind Ryan* and Mérouane Debbah

University of Oslo and Institut Eurecom

Free probability and random matrix theory has shown to be a fruitful combination in many fields of research, such as digital communications, nuclear physics and mathematical finance. The link between free probability and eigenvalue distributions of random matrices will be strengthened further in this paper. It will be shown how the concept of multiplicative free convolution can be used to express known results for eigenvalue distributions of a type of random matrices called Information-Plus-Noise matrices. The result is proved in a free probability framework, and some new results, useful for problems related to free probability, are presented in this context. The connection between free probability and estimators for covariance matrices is also made through the notion of free deconvolution.

*Partially sponsored by the project IFANY (INRIA), ACI MALCOM (CNRS) and the Institute for Mathematical Sciences, National University of Singapore

AMS 2000 subject classifications: Primary 60F99; secondary 60C05, 15A52

Keywords and phrases: Free probability, G-estimators, Sample covariance matrices