PCMI 2017 - Introduction to Random Matrix Theory
Handout #12 – 07.14.2017

REVIEW

The topics we covered in this course were:

1. Review of Linear Algebra: self-adjoint and unitary matrices, normal and diagonalizable matrices.

2. Review of Probability Theory: probability spaces, random variables, distribution and density functions, independence, expectation, variance, moments for random variables, characteristic functions, joint distribution and density functions, convergence of random variables, the Law of Large Numbers and the Central Limit Theorem, examples of random variables: discrete (Bernoulli, Binomial, Poisson) and continuous (Uniform, Exponential, Normal, Gamma, Chi Squared, Chi, Θ_ν, Tracy-Widom)

3. Classical Examples of Random Matrices: IID Random Matrix Ensembles (Bernoulli, real Gaussian, complex Gaussian), symmetric Wigner (symetric Bernoulli, GOE), Hermitian Wigner (GUE).

4. The Wigner Semicircle Law and the Circular Law.

5. Invariance Properties of GOE and GUE.

6. The Gaussian Beta Ensemble, its matrix representation and the formula for its joint eigenvalue density.

7. The Airy function and the Tracy-Widom distribution.

8. The local distribution of eigenvalues (bulk scaling limit) for Gaussian Beta Ensembles.

9. The Hermite polynomials and the k-point correlation function for GUE.

10. The circular Beta ensemble and its matrix representation.

11. Random Schrödinger Operators and random CMV matrices.