Now we have all the tools to

1. Establish mapping that relate problems involving random matrices and problems in stat. mech of disordered systems
2. Solve those problems using spin glass techniques

The rest of the lectures we are going to do them by working in groups. The main point is to express, interchange and to try out ideas.

Mapping I

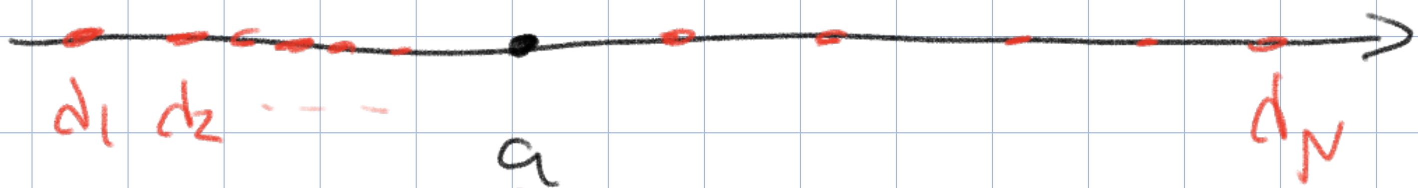
Consider ensemble of $N \times N$ symmetric random matrices. Consider also the empirical spectral density of a given matrix A with spectrum $\vec{\lambda}^A = (\lambda_1^A, \ldots, \lambda_N^A)$

$$\rho_A(\lambda) = \frac{1}{N}\sum_{i=1}^{N}\delta(\lambda-\lambda_i^A)$$

Map $\rho_A(\lambda)$ to a type of "stat mech" problem

Mapping 2

Given a real symmetric $N\times N$ matrix A, consider the # of eigenvalues to the left of the point a on the real line



# of eigenvalues to the left of a | this is a RV, if A is random of course

$$N_A(a) = \sum_{i=1}^{N}\Theta(a-\lambda_i^A)$$

Introduce the Moment generating function of $N_A(a)$

$$G_a(\alpha) = \left\langle e^{\alpha N_A(a)} \right\rangle_A$$

Map $G_a(\alpha)$ into a problem of stat. mech

Mapping 3

Consider the # of eigenvalues inside an interval $[a,b]$, $N_A(a,b)$. Introduce

$$G_{(a,b)}(\alpha) = \left\langle e^{\alpha N_A(a,b)} \right\rangle_A$$

Map $G_{(a,b)}(\alpha)$ into a problem in the context of stat. mech

Mapping 4.

Investigate the expectation value of the empirical spectral density, conditioned to finding a certain # of eigenvalues to the left of a.