**Random Matrix Products**

**Central Limit Theorem for number products**

Consider a random variable product of numbers



We can write this random variable as:



What’s the distribution of ν? Well,



and so ν approaches a normal distribution:



and higher moments will go as higher powers of 1/N. Another way we can express it is:



where νave = <ln(m)>1 and νstd = √<ln(m)>2, and W is a N(0,1) variable. So ν approaches a delta distribution, and can be considered a pure # in the large N limit. What is the distribution of lnPN? Well, lnPN = Nν, so:



I’ll presume the moments get smaller. Then lng goes as a Gaussian. So I guess it’s log-normal (and not delta). What about PN itself?

**Central Limit Theorem for matrix products**

Now he establishes some results about random matrices. First, suppose that we have a bunch of M’s identically distributed, and well-behaved in some sense. And let M(N) = M0×M1×M2×…×MN. Then he also says, the following limit exists:



and the U and ν are evidently delta distributed about some values? The ν’s are called the Lyapunov exponents. The largest Lyapunov exponent is called, well, νmax. There are some ways to calculate it. He says,



where | | represents the Euclidean norm. Note that this norm is the same as:



So does Tr(ν) = νmax/2? But in Q1D case, ν­max = N/(N+1).