• **Junichiro Fukuchi** (Gakushuin Univ.): **Optimal Assignment of items for a Vending Machine.**

We investigate a method of finding the optimal assignment of items to columns in a vending machine. There are spaces called columns in a vending machine. A column in a vending machine is a space where stock of an item are held. We formulate a mathematical programming problem for the optimal column assignment under the stochastic demand and investigate properties of a heuristic method of finding the optimal solution.

We assume that the demand processes for items are independent Poisson processes. The objective function in our formulation is the long-run profit rate under joint replenishment policy. Since replenishment cost for a vending machine is not low, some type of joint replenishment policy is used in practice. We assume that the inventory is continuously reviewed and the lead time for a replenishment is zero. We consider the following joint replenishment policy.

1. Stock is replenished at the instance that some item is sold out.
2. All the items are replenished to the initial level when an item is replenished.

The problem to be solved is a nonlinear integer programming problem with many local maxima. We use the Life Span Method, a variant of the tabu search, to obtain a near optimal solution. The results of numerical experiments will be given.

• **Tom Kurtz** (Univ. Wisconsin, Madison): **Prophetic constructions of branching and related processes.**

A collection of well-known population models (branching processes, branching Markov processes, branching processes in random environments, etc.) is constructed in a manner that associates with each individual in the population a characteristic called a level. If the levels are known to an observer, then a great deal is known about the future behavior of individuals (e.g., the exact time of death). If the levels are not known, then the models evolve as the observer would expect from their classical descriptions. The constructions enable straightforward proofs of a variety of known and not-so-well-known results including limit theorems, conditioning arguments, and derivation of properties of genealogies.

• **Soumen Lahiri** (Texas A& M Univ.): **Asymptotic expansions for the sample sum of a class of weakly dependent spatial process.**

Consider a vector valued random field on the integer d-lattice that is driven by a collection of independent random vectors. We obtain asymptotic expansions in the central limit theorem for the sample sum and related moderate deviation inequalities. The main results are illustrated with various classes of weakly dependent temporal and spatial processes commonly used in statistics. (Joint work with Arindam Chatterjee).

• **Steven Lalley** (Univ. of Chicago): **Self-Intersections of Random and Closed Geodesics on Negatively Curved Surfaces.**

Choose a point and a direction randomly on a compact, negatively curved surface, and follow the geodesic ray in this direction for a long distance L. How many times N(L) will this geodesic segment cross itself? A simple argument shows that $N(L) / L^2$ converges almost surely to a constant K; furthermore, a similar statement is true for a randomly chosen closed geodesic. How big are the fluctuations of N(L) around the mean? We will show they are of order L, and that $[N(L) - K L^2] / L$ converges in distribution. But we will also show that if only self-crossings in a small region of the surface are counted then the fluctuations are of order $L^{3/2}$. 
• **Mukul Majumdar** (Cornell Univ.): **Survival in Walrasian Equilibrium.**

Using the framework of an exchange economy (Nikaido (1956)) with many agents, I shall first introduce the concept of a Walrasian or "competitive" equilibrium. Among the important issues are 1) the existence of an equilibrium (perhaps the first decisive result came from A. Wald (1936)) and 2) its Pareto efficiency (the fundamental paper by K.J. Arrow (1951) on the connection between Walrasian equilibrium and Pareto efficiency appeared in the *Proceedings of the Second Berkeley Symposium on Mathematical Statistics and Probability*). I shall review two important results (the Gale-Nikaido-Debreu Lemma and Uzawa's Theorem) that capture the relation between the existence problem and the fixed point theorem of Kakutani (1941). I shall then move on to the question of survival of an agent in an equilibrium, a theme that was not prominent in the sophisticated development of the Walras-Pareto theory. I shall review some results on characterizing the nature of equilibrium prices and the probability of survival when the endowments are subjected to random shocks.

• **Timo Seppäläinen** (Univ. Wisconsin, Madison): **Fluctuation bounds for a class of zero range processes.**

We look at the fluctuations of particle current in stationary one-dimensional asymmetric particle systems with nonlinear flux. It is expected that the current seen by an observer traveling at the characteristic speed has fluctuations of magnitude $t^{1/3}$ and limits that obey Tracy-Widom related distributions. The correct order of magnitude in the sense of variance bounds is known for asymmetric exclusion processes and some flavors of zero range and bricklayer processes. For exclusion processes exact distributional limits are also known. This talk discusses the case of zero range processes. We explain how the variance bound for the current follows from superdiffusive moment bounds for a second class particle. The proofs rely on coupling constructions. (Joint work with Marton Balazs and Julia Komjathy, Budapest.)

• **Anand N. Vidyashankar** (Cornell Univ.): **Computable Versions of Kesten-Stigum Martingale in Branching Processes and Related limit laws.**

Consider a single type supercritical branching process $\{Z_n : n \geq 1\}$ initiated by a single ancestor. It is well-known that $W_n = m^{-n} Z_n$ is a non-negative martingale sequence and hence converges to a limit $W$ with probability one. Work of Kesten and Stigum shows that the limit $W$ is non-degenerate if and only if $E(Z_1 \log^+ Z_1 ) < \infty$, where $\log^+(x) = \log(\max(x, e))$. Motivated by recent work on ancestral inference, I will describe computable versions of the above martingale and related limit laws. Extensions to multi type branching processes and branching processes in random environments will also be described.

• **Ofer Zeitouni** (Univ. of Minnesota, Weizmann Inst. of Science, Israel): **The single ring theorem.**

A well studied family of Hermitian random matrices are those whose law is of the form $Z_n^{-1} e^{\text{tr}V(X_n)} dX_n$. Depending on the potential $V$, the support of the limit of the empirical measure of eigenvalues can be a single interval, or several intervals. The same holds for the singular values of non-Hermitian matrices distributed according to the law $Z_n^{-1} e^{\text{tr}V(X_nX_n^*)} dX_n$. Surprisingly, however, the eigenvalues all asymptotically belong to a single ring, as predicted by physicists Feinberg and Zee.

I will explain the result and give an idea of the tools used in the proof. This is joint work with Alice Guionnet and Manjunath Krishnapur.