**THE CONCORDIA INSTITUTE FOR INFORMATION SYSTEMS ENGINEERING
IS PLEASED TO PRESENT THE FOLLOWING GUEST LECTURE IN
OUR CIISE DISTINGUISHED SEMINAR SERIES**

Dr. Pierre Hansen, Professor
GERAD and HEC Montréal

Clustering on graphs

Clustering aims at solving the following general problem: given a set of entities, find subsets (also called clusters, modules or communities) which are homogeneous and well separated. As the concepts of homogeneity and separation can be made precise in many ways there are a large number of clustering problems. They are solved exactly by combinatorial algorithms in a few cases and more often, particularly for large datasets, solved approximately by heuristics. Given the growing interest in large networks, or graphs, several communities are very active in developing the theory and applications of clustering on networks. The most active in this area appear to be the physicists. But, there is also much works in other communities such as biologists, sociologists, computer scientists, operational researchers and engineers. The presently most used clustering criterion is modularity. It has been defined in 2004 by Mark Newman and Michelle Girvan. The modularity of a cluster is the difference between the number of edges in that cluster and the expected number of edges assuming that they were drawn at random with the same distribution of vertex degrees. The modularity of a partition is the sum of the modularities of its clusters. Many heuristics, based on various concepts, lead rapidly to partitions or hierarchies of partitions closed to be optimal for modularity maximization. Exact methods are much rarer. I will present a critique of the modularity concept, as well as new exact algorithms both for partitioning and for divisive hierarchical clustering. Using stabilized column generation the size of exactly solved problems is multiplied by a factor of about five.

Biography: Ph.D in Mathematics, University of Brussels, 1974. Taught in Belgium, France, USA, Canada, and for short periods in Italy, Germany, Hong Kong, China and Brazil. Currently Professor and holder of the Data Mining Chair at HEC Montréal. Recipient of several research prizes including the EURO Gold Medal, 1986, the Merit Award of the Canadian Operational Research Society, 1999, and the Pierre Rousseau Prize of ACFAS 2008. Author, and most of the time co-author with colleagues and students, of more than 300 papers in refereed journals from various fields: *Mathematical Programming, Mathematics of Operations Research, Management Science, Journal of Combinatorial Theory A, Journal of Graph Theory, Linear Algebra and Applications, Discrete Mathematics, Discrete Applied Mathematics, American Economic Review, Journal of Regional Science, Journal of Public Economics, Journal of Chemical Information and Computer Sciences, Bulletin of Mathematical Biology, Journal of the American Statistical Association, IEEE Transactions on Pattern Analysis and Machine Intelligence, Physical Review E* and others. Fellow of the Royal Society of Canada, 1999. Member of the International Academy of Mathematical Chemistry, 2005. Research interests: combinatorial and global optimization and their applications in various fields such as data mining, clustering, graph and hypergraph theory, location and distribution, mathematical chemistry, computer-aided discovery.

Thursday, March 31, 2011   **16:00 – 17:00**   **EV003.309**