Department of Mathematics and Statistics, McGill University
Topics in analysis (Math 740):
Measurable and symbolic dynamical systems
Course Outline, Winter 2012

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Prerequisites A working knowledge of measure or probability theory. Some knowledge of spectral theory of unitary transformations and the conditional expectation.

Texts: We will use the following books:

1. *Introduction to ergodic theory* (Walters),
2. *Fundamentals of measurable dynamics* (Rudolph)
3. *Theory of Bernoulli Shifts* (Shields)
4. *Symbolic dynamics* (Kitchens),
5. *Ergodic theory via joinings* (Glasner)
6. *Introduction to the modern theory of dynamical systems* (Katok and Hasselblatt)
7. *An outline of ergodic theory* (Kalikow and McCutcheon)

Syllabus: Measure-preserving transformations; topological dynamical systems. Ergodicity and topological transitivity. Rokhlin's lemma (measure and topological version). The Birkhoff and von Neumann ergodic theorems. Families of systems: group rotations, Denjoy systems, Bernoulli and Markov automorphisms, subshifts of finite type, cellular automata, Bratteli-Vershik systems. Hyperbolic dynamcial systems. Anosov flows and geodesic flows on Riemannian surfaces of negative curvature. Skew products and isometric extensions. Invariant measures, measure rigidity, uniquely ergodic systems. Mixing and Spectral invariants. Partitions and symbolic representations of transformations. Measure theoretic and topological entropy. Bratteli-Vershik systems. Loosely Bernoulli systems and K-automorphisms. Joinings of measure preserving systems. The Ornstein isomorphism theorem using joinings. The Jewett-Krieger theorem. Zero-entropy systems. Time permitting: Szemeredi-type theorems, orbit equivalence, dimension groups and K-theory of Cantor dynamical systems. Time permitting: Ambrose Kakutani theorem and Kakutani equivalence.

Marking Scheme: Five assignments worth 20% each.