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12. Probability and Statistics

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Uniform integrability of L^1-bounded matingales.

Let $(X, |\ |)$ be Bnach space having Radon-Nikodým property. Consider X-valued martingales on a probability space (Ω, a, P) and let $L_X^p(\Omega, a, P)$ $(1 \leq p \leq \infty)$ be the set of all p the power Bochner integrable X-valued functions on (Ω, a, P). Then Theorem 1. Let $f = (f_n)$ be a martingale. Then f is L_X^1-boundend $\Leftrightarrow$ f is L_X^p-bounded $(\forall p > 1)$. Thus, L_X^1-bounded martingale f is uniformly integrable. Theorem 2. As set $L_X^1(\Omega, a, P) = L_X^\infty(\Omega, a, P)$. Theorem 3. L_1-bounded submartingale $f = (f_n)$ is L^∞-bounded. Thus, f is uniformly integrable. Consider Hardy space on unit disc $H^p \equiv H^p([-\pi, \pi], a, P)$ $(\subset L^1([-\pi, \pi], a, P))$ $(1 \leq p \leq \infty)$ with $\| F \|_{H^\infty} \equiv \lim_{p \to \infty} \| F \|_{H^p}$. Then Theorem 4. $H^1 = H^\infty$.

Reference: T. Shintani, Martingale transfoms in a Banach space, (Submitted), (1997).