

TOPICS IN STOCHASTIC ANALYSIS

Spring 2012

Department of Mathematics
University of Texas at Austin

Instructor: *Gordan Žitković*

Students will be introduced to an important area of research in stochastic analysis, namely Backward Stochastic Differential Equations. A good understanding of probability and stochastic calculus at the level of the prelim courses Theory of Probability I and II is required.

An adapted solution to a backward stochastic differential equation (BSDE) with the terminal condition $\xi \in \mathcal{F}_T$ and the driver f is a pair of adapted processes (Y, Z) with

$$Y_t = \xi + \int_t^T f(s, Y_s, Z_s) ds + \int_t^T Z_s dW_s.$$

The effect of the preferred direction of the flow of information on the choice of the particular orientation of time's arrow precludes the naïve view of BSDEs as time-reversed (forward) stochastic differential equations. Nevertheless (or, perhaps, therefore), the theory of BSDEs is one of the most active areas of research in stochastic analysis.

Our goal is to develop the necessary probabilistic tools (including BMO martingales and the corresponding duality theory) for an existence and uniqueness theory of a general class of BSDE. After that, a number of applications in stochastic control and mathematical finance will be presented. The first part of the course will follow [1], while the rest of the material will be drawn from various sources.

References

- [1] N. KAZAMAKI, *Continuous exponential martingales and BMO*, vol. 1579 of *Lecture Notes in Mathematics*. Berlin: Springer-Verlag, 1994.