1 Random Sums - See Chap 2.3

- Definition of random sum.
- Definition and properties of conditional distribution function and density function.
- Moments (mean and variance) of random sum.
- Distribution of random sum.
- Example: $\xi_i \sim Exp(\lambda), N \sim Geo(\beta)$, then random sum $X \sim Exp(\lambda \beta)$.

2 Conditional Probability and Expectations (Continuous Case) - See Chap 2.4

- Definitions and properties of conditional probability density function, conditional distribution function, conditional expectation.
- Example: If $X,Y \sim f_{X,Y}(x,y) = \frac{1}{y} \exp^{-x/y} - y$ for $x,y > 0$, then $f_{X|Y}(x|y) = \frac{1}{y} \exp^{-x/y}$, for $x,y > 0$.

3 Martingales - See Chap 2.5

- Definition of stochastic process, discrete-time and continuous time stochastic process.
- Definition and properties of discrete-time martingales.
- Martingales have constant mean.
- Martingale property: $\mathbb{E}[X_{n+1}|X_0, X_1, \ldots, X_n] = X_n$ or equivalently $\mathbb{E}[X_m|X_0, X_1, \ldots, X_n] = X_n$, for any $m \geq n$.
- Markov inequality