MATH 337

Distributions and Markov Chains

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Course website: http://www.mast.queensu.ca/~math337/index.shtml
Common distributions

- Binomial
- Bernoulli
- Poisson
- Exponential
- Gamma
- Weibull
- Beta
- Kumaraswamy
- Normal
- Log-Normal
Stochastic process

- Collection of random variables \( \{X_t\} \) where the index \( t \) runs through a given set \( T \)
- \( X \) is a measurable characteristic
- \( X \) is defined over a sample space e.g. \( X \in \{0, \ldots, M\} \)
Ex. Inventory problem

- Let $D_1, D_2, \ldots$ represent demands for a product for week 1, week 2, ..., respectively.

- Assume $D_i$’s are i.i.d. random variables

- Let $X_0$ be the # of product on hand at the beginning (assume $X_0 = 3$)

- Let $X_i$ be the # of product at the end of week $i$
The Markov property

\[ P(X_{t+1} = j | X_0 = k_0, X_1 = k_1, \ldots, X_t = i) = P(X_{t+1} | X_t = i) \]
Stationary transition probabilities

\[ P(X_t + 1 = j | X_t = i) = P(X_1 = j | X_0 = i) \]
Finite-state Markov Chain

Any stochastic process s.t.

1) Finite # of states

2) Markov property

3) Stationary transition probabilities

4) A set of initial probabilities $P(X_0 = i) \ \forall i$