Zoom Class-March 30, 2020

Wednesday, March 25, 2020 10:37 AM

- Welcome + Stay healthy
- Course Web page http://www.math.ucsd.edu/~bdriver/180B_S2020/index.htm
- CANVAS https://canvas.ucsd.edu/
- General Comments about the course
- What is the topic of 180B (180C).

Deterministic Dynamical Systems

1. there exists $f : S \to S$ and a state x_n then evolves according to the rule $x_{n+1} = f(x_n)$. [More generally one might allow $x_{n+1} = f_n(x_0, \dots, x_n)$ where $f_n : S^{n+1} \to S$ is a given function for each n.
2. There exists a vector field f on S (where now $S = \mathbb{R}^d$ or a manifold) such that $\dot{x}(t) = f(x(t))$. [More generally, we might allow for $\dot{x}(t) = f\left(t; x|_{[0,t]}\right)$, a functional differential equation.]

Ex. Leslie – Gower model

$$x_i(t+1) = \frac{b_i x_i(t)}{1 + \sum_{j=1}^n c_j x_j(t)}, \quad i = 1, \dots, n. \qquad (1)$$

$$x_i(t+1) = \frac{c_i x_i(t)}{1+\sum_{j=1}^{n} c_j x_j(t)}, \quad i = 1, \ldots, n. \qquad (1)$$

Ex 2. $\Longrightarrow$ 1. ODE to Discrete Dynamical system

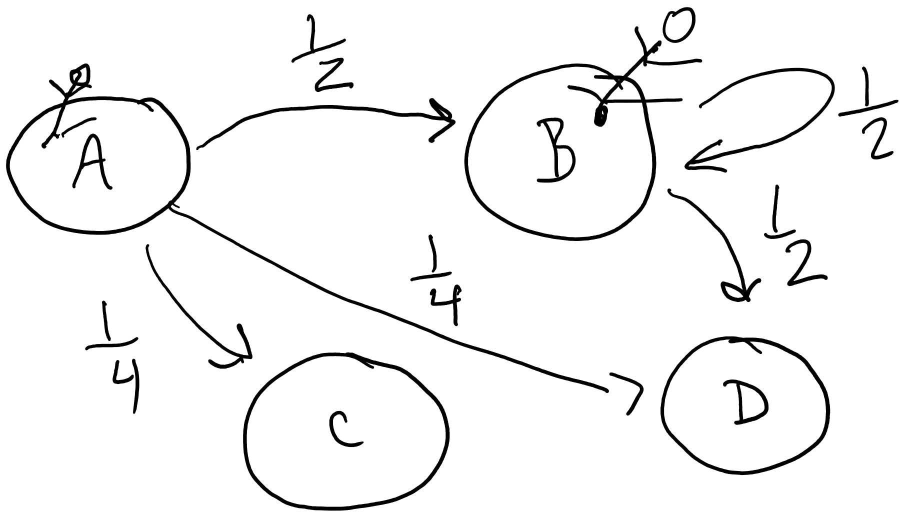
$$\dot{x}(t) = f(x(t))$$

$$\frac{x(t+h)-x(t)}{h} \simeq f(x(t)) \quad \Big| \quad x(t+h) = x(t) + hf(x(t))$$

Definition 1.1 (Stochastic Process via Wikipedia). *..., a stochastic process, or often random process, is a collection of random variables representing the evolution of some system of random values over time. This is the probabilistic counterpart to a deterministic process (or deterministic system). Instead of describing a process which can only evolve in one way (as in the case, for example, of solutions of an ordinary differential equation), in a stochastic, or random process, there is some indeterminacy: even if the initial condition (or starting point) is known, there are several (often infinitely many) directions in which the process may evolve.*

Stochastic Evolution (Add Randomness)

1. $$X_{n+1} = f(X_n, \xi_n)$$



http://markov.yoriz.co.uk/

https://www.mathematik.tu-clausthal.de/en/mathematics-interactive/simulation/markov-chain-discrete/

https://www.zweigmedia.com/RealWorld/markov/markov.html

2. (more in MATH 180C)

$$\text{“}\dot{X}_t = f_t\left(X_t\right)\text{”}$$

Poisson point process in last 1/4 to 1/3 of the course.

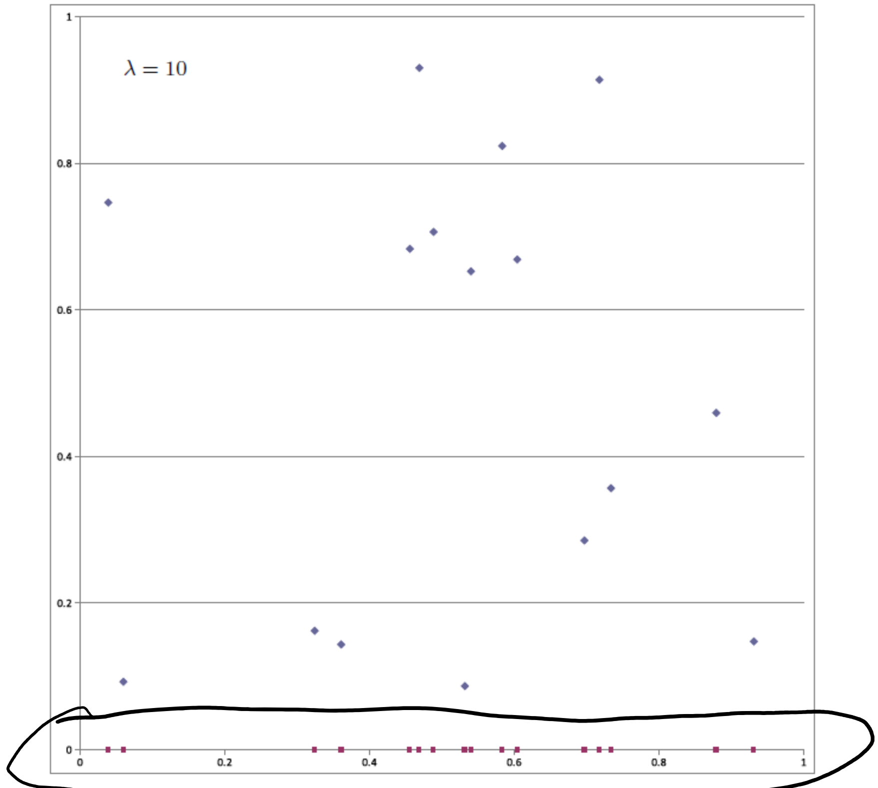


Fig. 13.1. A Poisson point process typical sample point in the unit square and the unit interval with "intensity" equal to 10. This picture was generalted with the aid of Theorem 13.66 below.

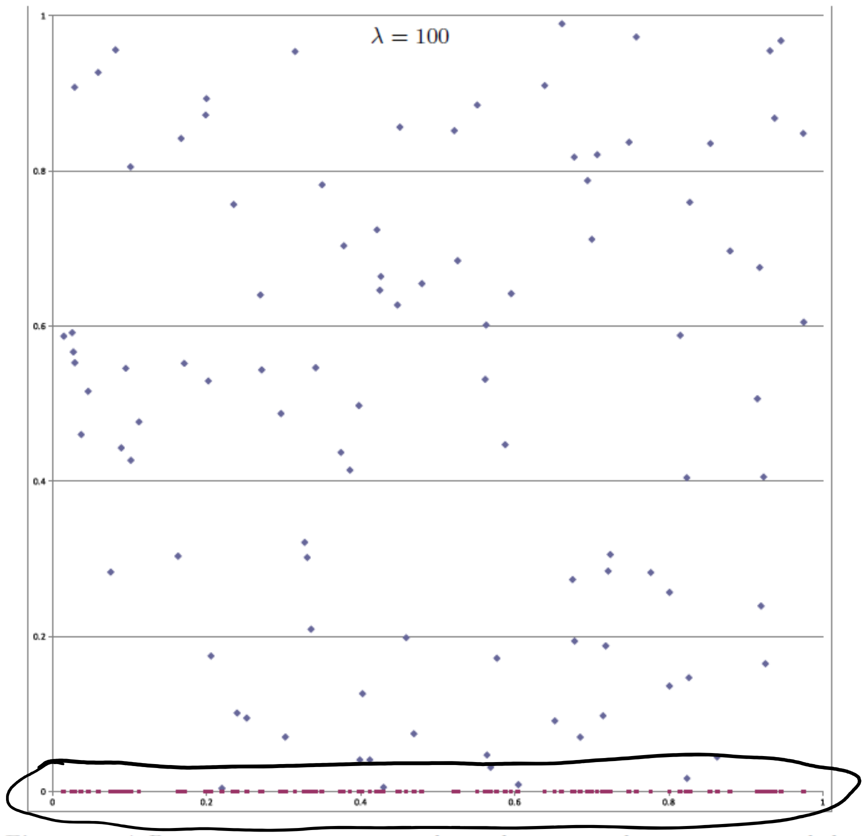


Fig. 13.2. A Poisson point process typical sample point in the unit square and the unit interval with "intensity" equal to 100. This picture was generalted with the aid of Theorem 13.66 below.

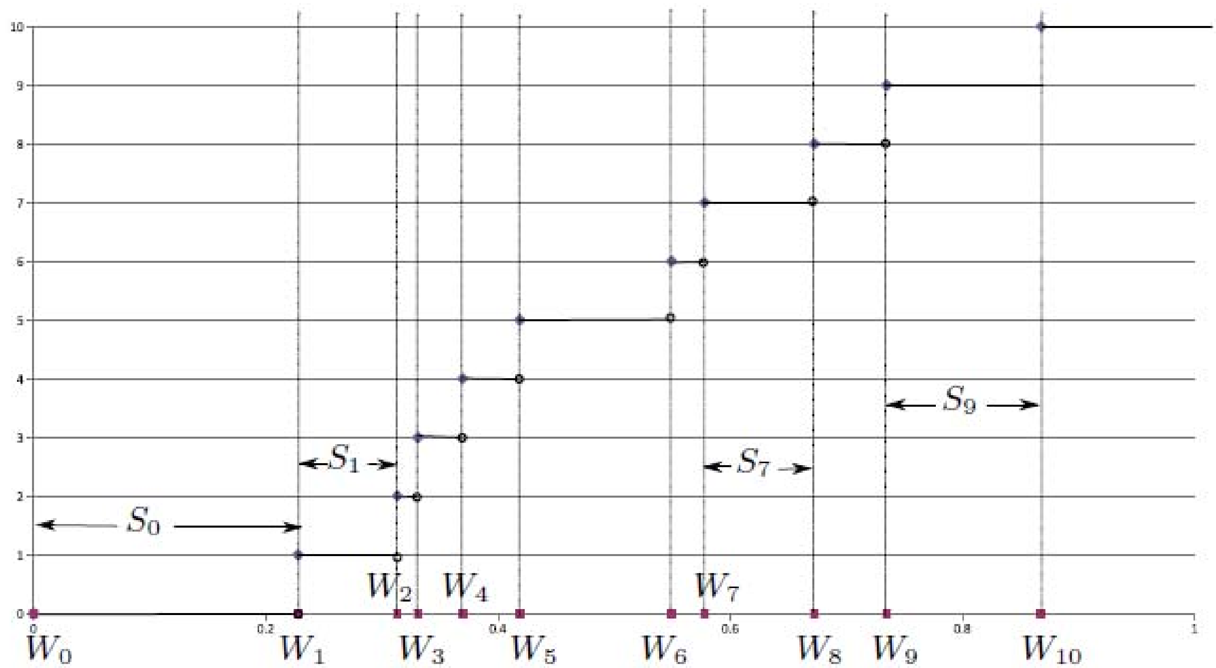


Fig. 13.9. A sample path of a Poisson process with the the arival and sojourn times indicated on the picture.