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EE640 lecture 1

Historical Perspective of Probability:

(NEED) Complicated universe requires complicated deterministic explanation.

(ANALYSIS) It was recognized that there were slight differences between the same experiments

(SYNTHESIS) Tula realized that noise signatures could be used to represent information.

Present day communication trends are towards hybrid deterministic and stochastic techniques for encoding and modulating information signals.

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Practical Applications

Test Data Synthesis

Model real systems

Encoding signals

Modulation of information signals
(spread spectrum)

Different Types of Probability

A. Definition - neural nets

B. Prob. as Ratio of Favorable outcomes.

Ex: Assume equally likely outcomes of fair coin.

Count total ~~number~~ number of possible outcomes and divide into the ~~same~~ number that satisfies

$$\text{Event } E \quad \therefore \quad P = \frac{NE}{N}$$

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C. Prob. Measure of Frequency of occurrence

$$P(E) = \lim_{n \rightarrow \infty} \frac{n_E}{n}$$

$$0 \leq P(E) \leq 1$$

note: $\frac{n_E}{n} = p$ is less likely as $n \rightarrow \infty$

For a fair coin toss the value of

$$P_n = \left| \frac{n_E}{n} - \frac{1}{2} \right|$$

becomes smaller as n gets larger,

("convergence")

D. Prob. Based on axiomatic Theory

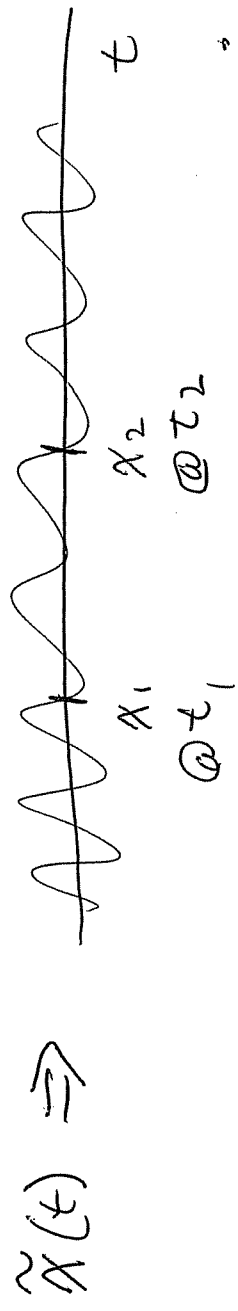
Kolmogorov \rightarrow Probability measure

Use of Set Theory to explain frequency of occurrence.

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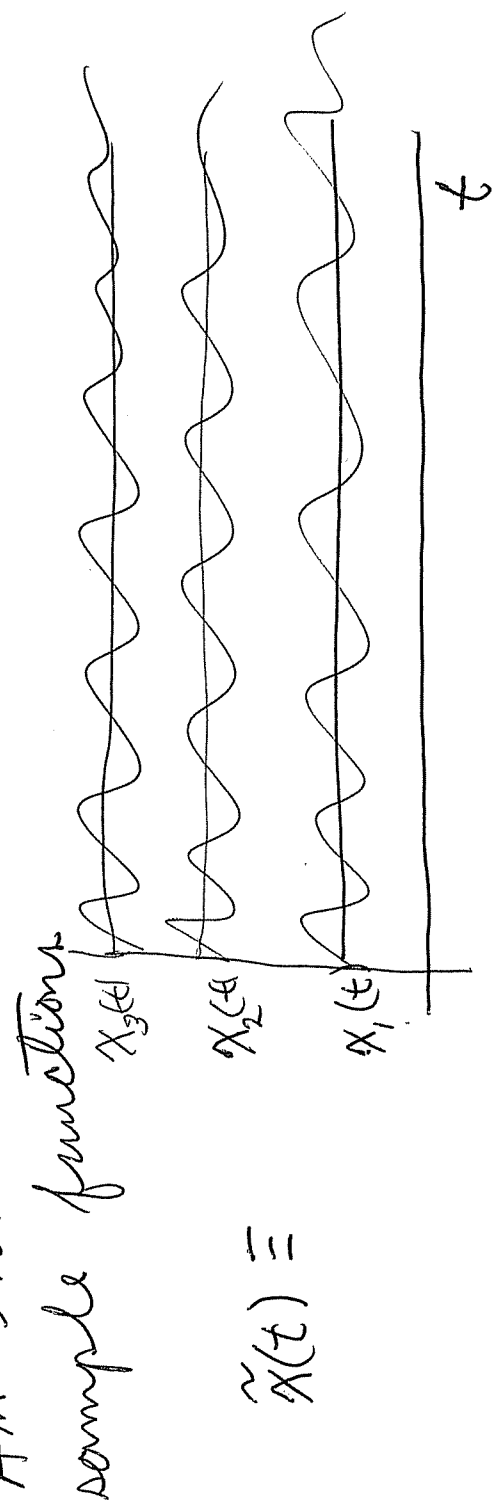
E. Stochastic System (Wiener)

A random value varying with time



Describe $\tilde{X}(t)$ by ensemble statistics.

The probability measures relate different time instances of $\tilde{X}(t)$ such as $f(X_1, X_2; t_1, t_2)$



$\tilde{X}(t) \equiv$