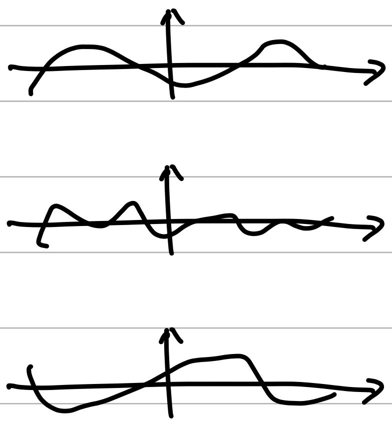
13. Random Process

Stochastic Process

X(t) 시간에 대한

- Sample function $x(t, \text{outcome } s)$ 몇번째인지



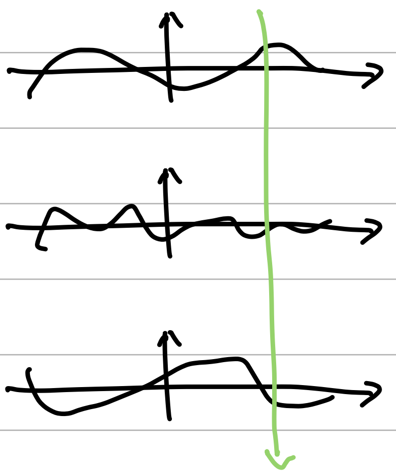
$x(t, s_1)$

$x(t, s_2)$

$x(t, s_3)$

각각의 Sample function을 모두 모은 것 : ensemble

- ensemble average, time average



$x(t, s_1)$

$x(t, s_2)$

$$\frac{1}{\text{관찰한 시간}}\int_0^{\text{관찰한 시간}} x(t, \text{특정회차})\, dt$$

$x(t, s_3)$ → 특정회차의 평균 : time average

특정 시간의 평균값 : ensemble average. $E[X(\text{특정시간})]$

iid Random Sequence

- $X_1 \cdots X_n$ 가 iid 이라면
  - $P_{X_1 \cdots X_n}(x_1 \cdots x_n) = P_X(x_1) \cdots P_X(x_n)$
  - $f_{X_1 \cdots X_n}(x_1 \cdots x_n) = f_X(x_1) \cdots f_X(x_n)$

$$P_{\underline{X}}(\underline{x}) = P_X(x_1) \cdots P_X(x_k) = \prod_{i=1}^{k} P_X(x_i)$$

$$f_{\underline{X}}(\underline{x}) = f_X(x_1) \cdots f_X(x_k) = \prod_{i=1}^{k} f_X(x_i)$$

Bernoulli Process

X_n은 iid random sequence 이고, 각각은 베르누이 RV 이다.

$$P_{X_i}(x_i) = \begin{cases} p^{x_i}(1-p)^{1-x_i} & x_i \in \{0, 1\} \\ 0 & \text{o.w.} \end{cases}$$

$$P_{\underline{X}}(\underline{x}) = \prod_{i=1}^{n} p^{x_i}(1-p)^{1-x_i}$$

$k = x_1 + \cdots + x_n$ 이라하면

$$= p^k(1-p)^{n-k} = p^{x_1 + \cdots + x_n}(1-p)^{n-(x_1 + \cdots + x_n)}$$