

HW TC # 11

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Q1:  $X(t) = At + N(t)$ ,

Conditions for WSS

$E[X(t)]$  sabit olmalı.

$R_{XX}(t_1 - t_2) = R(\tau)$  olmalı,  $E[X(t)] = E[At + N(t)]$

$= \underbrace{A E[t] + E[N(t)]}_{\text{constant in time}} \Rightarrow$

$E[X(t_1) \cdot X(t_2)] = E[(At_1 + N(t_1)) \cdot (At_2 + N(t_2))]$

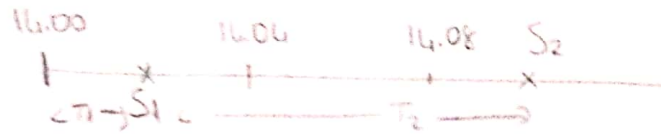
~~$E[N(t_1)] = E[N(t_2)] = 0$~~  so

$E[A^2 t_1 t_2] = A^2 E[t_1 t_2] = A^2 \cdot R_{XX}(0)$

$\underbrace{E[X^2(t)]}_{\text{}} = A^2 \cdot \frac{N_0}{2\pi} \Delta\omega$

Q2:  $\lambda = \frac{1}{2 \text{ min}}$

(a)



$$S_k = \sum_{i=1}^k T_i, \quad S_1 = T_1, \quad S_2 = T_1 + T_2$$

$$P\{S_1 < a = 4, S_2 > b = 8\}$$

$$= P\{T_1 < a, T_1 + T_2 > b\} \quad \text{Max}(T_1) = a \text{ so for max value}$$

$$= P\{T_1 < a, T_2 > b - a\} \quad a + T_2 > b, \underline{T_2 > b - a}$$

$$= P\{T_1 < 4, T_2 > 4\} \rightarrow \text{independent from each other.}$$

$$= P\{T_1 < 4\} \cdot P\{T_2 > 4\}$$

$$S_1 \sim \text{Erlang}(\lambda = \frac{1}{2 \text{ min}}, k = 1)$$

$$S_2 - S_1 \sim \text{Erlang}(\lambda = \frac{1}{2 \text{ min}}, k = 1)$$

$$\underline{\text{cont. RV}} \quad P\{S_1 < 4\} \cdot (1 - P\{S_2 - S_1 < 4\})$$

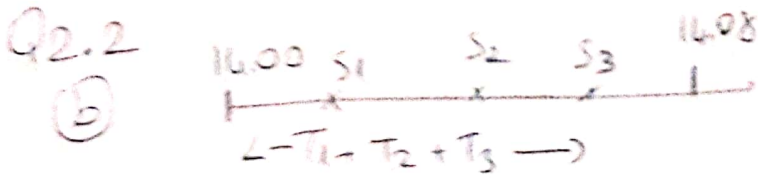
$$cdf_{S_1}(u) = cdf_{S_2 - S_1}(u) = 1 - \sum_{n=0}^{\infty} \frac{1}{n!} \cdot \exp(-\lambda x) \cdot (\lambda x)^n$$

$$\exp(-\frac{1}{2} \cdot 4) = \exp(-2)$$

$$P\{S_1 < a = 4, S_2 > b = 8\} = \exp(-2) \cdot (1 - \exp(-2)) =$$

$$\underline{\underline{0.135 \cdot (1 - 0.135) = 0.1167}}$$

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$$S_k = \sum_{i=1}^k T_i \quad S_3 = T_1 + T_2 + T_3$$

$$P\{S_3 \leq c = 8 \text{ min}\}$$

$$P\{S_3 \leq c = 8 \text{ min}\} = \text{cdf}_{S_3}(8)$$

$$S_3 \sim \text{Erlang}(\lambda = \frac{1}{2}, k=3)$$

$$= 1 - \sum_{n=0}^{2} \frac{1}{n!} \cdot \exp(-\lambda x) \cdot (\lambda x)^n$$

$$\text{cdf}_X(x) = 1 - \sum_{n=0}^{k-1} \frac{1}{n!} e^{-\lambda x} (\lambda x)^n$$

$$x \rightarrow 8$$

$$\lambda \rightarrow \frac{1}{2} \text{ min}$$

$$= 1 - \sum_{n=0}^{2} \frac{1}{n!} \exp(-4) \cdot (4)^n$$

$$= 1 - \left( 1 \cdot \exp(-4) \cdot 4 + \frac{1}{2} \cdot \exp(-4) \cdot 16 \right)$$

$$= 1 - (\exp(-4) \cdot 12) = 1 - 0.2197 = \underline{\underline{0.7802}}$$

Q2.3

(C)



$$S_n = \sum_{i=1}^n T_i, \quad S_n = T_1 + T_2 + \dots + T_n$$

$$P\{S_n < d = 2 \text{ min}\} = ?$$

$$S_n = \text{Erlang}\left(\lambda = \frac{1}{2 \text{ min}}, k = n\right)$$

cont. QV

$$P\{S_n \leq d\} = \text{cdf}_{S_n}(d)$$

$$\text{cdf}_{S_n}(d) = 1 - \sum_{i=0}^{n-1} \frac{1}{i!} \cdot \exp(-\lambda x) \cdot (\lambda x)^i$$

$$= 1 - \sum_{i=0}^{n-1} \frac{1}{i!} \cdot \exp\left(-\frac{a}{2}\right) \cdot \left(\frac{a}{2}\right)^i$$

$n$  should be bigger than zero  $n > 0$

$a$  should be bigger than zero  $a > 0$  so  $t > 14.00$



Q3:  $A_k \sim \text{Uniform}(a_L, a_H)$   $k \in \{1, 2, \dots, 323\}$   
 $S_k \sim \text{Bernoulli}(p_{\text{sold}})$   $k \in \{1, 2, \dots, 323\}$   
 $V_k \sim \text{Bernoulli}(q_{\text{robbed}})$   $k \in \{1, 2, \dots, 323\}$

$p_{\text{sold}} + q_{\text{sold}} = 1$ ,  $p_{\text{robbed}} + q_{\text{robbed}} = 1$

$g(k)$  is gain after  $k$ th sales

$g(1) = A_1 \cdot S_1 \cdot V_1$  ( $A_k$  kazancı miktarı,  $S_1$  satış olup olmadığını,  $V_1 \rightarrow$  ilk satışta soyulma durumunu belirtir)  $\rightarrow$  ilk satış için

$S_k = 1$  (satış oldu),  $V_k = 1$  (Yagına alınması) bu durumda  $g(1) = A_1$  olacaktır.

$$g(k+1) = [g(k) + A_{k+1} \cdot S_{k+1}] \cdot V_{k+1}$$

$V_{k+1} = 0$  (Pazar yağmaldıysa)  $\rightarrow g(k+1) = 0$   $g(k)$  her ne dursa olsun.

$V_{k+1} = 1$  ise yağma olmadıysa  $\rightarrow g(k+1) = g(k) + A_{k+1} \cdot S_{k+1}$

bu durumda  $g(k+1)$  değeri  $k$ . satışa kadar toplanan miktara  $(k+1)$ . satıştan gelen para eklenerek bulunur. Burada bir koşul daha var  $S_{k+1} \rightarrow (k+1)$ . satış gerçekleşmesi gerek tüm koşullar sağlandığında  $(k+1)$ . satış sonucu eline geçecek para

$g(k+1) = [g(k) + A_{k+1} \cdot S_{k+1}] \cdot V_{k+1}$  ile hesaplanır.

Fikrit'e alınması için

for  $(k+1) = 2m$   $V_{k+1} = 0$  } böylece her iki  
for  $(k+1) = 2m+1$   $V_{k+1} = 1$  } kazanda bir kazanç  
Sifirlanacaktır.