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Year. Month. Date. Subject :

S. 2.27 : a) $\lambda t = \left(\frac{10 \text{ calls}}{\text{minute}}\right) \cdot \left(\frac{1}{10} \text{ minute}\right) = 1$

$$Pr(x<3) = \sum_{k=0}^{2} \frac{1}{k!} e^{-1} = \frac{1}{e}\left(1+1+\frac{1}{2}\right) = \frac{5}{2e}$$

$$= 0/9197$$

b) $\lambda t = \left(\frac{10 \text{ calls}}{\text{minute}}\right) \cdot 6 \text{ minutes} = 60$

$$Pr(x<3) = \sum_{k=0}^{2} \frac{60^k}{k!} e^{-60} = e^{-60}\left(1+60+\frac{3600}{2}\right)$$

$$= 1861 \cdot e^{-60} = 1/627 \times 10^{-23}$$

S. 2.32 up to eq 2.30 in page 38

$$Px(k) = Pr(A) = \binom{n}{k} p^k (1-p)^{n-k} \quad k = 0, 1, 2$$

a) → $t = 1$ ⇒ if more than 1 error

occurs in 7-bit data block, decoder will be in error: thus the decoder probability is

$$\underset{\text{more than } t}{P_e} = \sum_{i=2}^{7} \binom{7}{i} (0/03)^i (1-0/03)^{7-i} = 0/0171$$

b) → similarly → $t = 2$ → $P_e = \sum_{i=3}^{15} \binom{15}{i} (0/03)^i (1-0/03)^{15-i}$

$$= 0/0094$$

c) similarly → $t=3$ → $P_e = \sum_{i=4}^{31} \binom{31}{i} (0/03)^i (1-0/03)^{31-i}$

$$= 0/0133$$

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5-2.37

I'll do it in furture if necessary

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5. Homework4 3.3 :

a) since this is a pdf the following integral lead to 1: $\int_{-\infty}^{\infty} f(x)dx = 1$

up to f(x) $\Longrightarrow$ $\int_{-\infty}^{0} f(x)\,dx = 1 \rightarrow \left.\frac{-a^{-bx}}{b\ln(a)}\right|_{-\infty}^{0} = 1$

$$\Rightarrow \frac{1}{b\ln(a)} + \lim_{x\to\infty}\left(\frac{-a^{-bx}}{b\ln(a)}\right) = 1$$

Here is two case arise $a>1$ and $0<a<1$

. the case $a<0$ is not possible because then f(x) can become negative → f(x) is pdf so it is impossible → first consider case $a>1$ this lead to finite value if only if $b<0$.

* second case: $a<1$ the limit will be finite only if $b>0$

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In both cases the limits to 0

and above eq. reduces to $\frac{-1}{b\ln(a)} = 1$

$$\boxed{a = e^{-\frac{1}{b}}}$$

$\Rightarrow f(x) = a^{-bx} = (e^{-\frac{1}{b}})^{bx} \rightarrow f(x) = e^{x}$

b) the CDF is given by

$$F(x) = \int_{-\infty}^{\infty} f(x)\,dx = \int_{-\infty}^{\infty} e^{x}\,dx$$

$$\Rightarrow F(x) = \begin{cases} e^{x} & x \leq 0 \\ 1 & 0 < x \end{cases}$$

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5. Homework 5

$$P_r(|S - 10| > 0.075) = 2\int_{9.9}^{9.925} f_S(s)\,ds$$

$$= 2\int_{9.9}^{9.925} 100(S - 9.9)\,ds = 2\int_{0}^{0.025} 100\,a\,da$$

$$= 100 \times (0.025)^2 = 0.0625$$

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Home work 6 :

let $P_r(M=0) = P_0$ and $P_r(M=1) = P_1$

$$f_{X|M=0}(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{x^2}{2\sigma^2}\right)$$

$$f_{X|M=1}(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-1)^2}{2\sigma^2}\right)$$

$$= \frac{P_0}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{x^2}{2\sigma^2}\right) + \frac{P_1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-1)^2}{2\sigma^2}\right)$$

$$P_r(M=0 \mid X=x) = \frac{f_{X|M=0}(x)}{f_X(x)}$$

$$= \frac{P_0 \exp\left(-\frac{x^2}{2\sigma^2}\right)}{P_0 \exp\left(-\frac{x^2}{2\sigma^2}\right) + P_1 \exp\left(-\frac{(x-1)^2}{2\sigma^2}\right)}$$

$$= \frac{1}{1 + \frac{P_1}{P_0} \exp\left(-\frac{(x-1)^2}{2\sigma^2} + \frac{x^2}{2\sigma^2}\right)}$$

$$= \frac{1}{1 + \frac{P_1}{P_0} \exp\left(\frac{x}{\sigma^2} - \frac{1}{2\sigma^2}\right)}$$

we have to plot this function for the following combinations

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(a) $P_0 = \frac{1}{2}, \; P_1 = \frac{1}{2}, \; \sigma^2 = 1$

$$Pr(M=0 \mid X=x) = \frac{1}{1+\exp(x-\frac{1}{2})}$$

$P_0 = \frac{1}{2}, \; P_1 = \frac{1}{2}, \; \sigma^2 = 5$

$$P(M=0 \mid X=x) = \frac{1}{1+\exp(\frac{x}{5}-\frac{1}{10})}$$

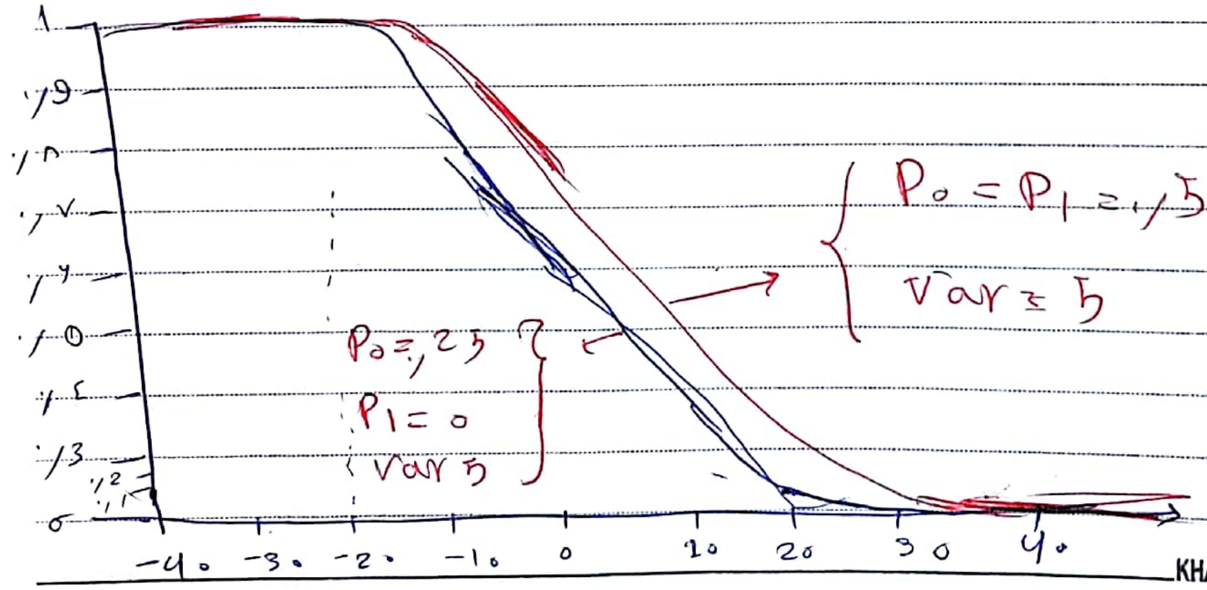
(b) $P_0 = \frac{1}{4}, \; P_1 = \frac{3}{4}, \; \sigma^2 = 1$

$$Pr(M=0 \mid x=x) = \frac{1}{1+3\exp(x-\frac{1}{2})}$$

$P_0 = \frac{1}{4}, \; P_1 = \frac{3}{4}, \; \sigma^2 = 5$

$$Pr(M=0 \mid x=x) = \frac{1}{1+3\exp(\frac{x}{5}-\frac{1}{20})}$$

Plot of all distibutaions



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