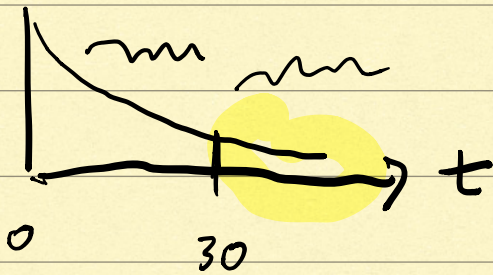


PS 4 A)



$$p_T(t) = \frac{1}{\tau} e^{-t/\tau}$$

$$F_T(t) = 1 - e^{-t/\tau} \\ = \mathbb{P}(T < t)$$

$$E[T_{\text{wait}}]$$

$$\frac{E[T_{\text{wait}} \cap T > 30]}{\cancel{\mathbb{P}(T > 30)}}$$

$$= E[T_{\text{wait}} \mid \text{went over}] \cdot \cancel{\mathbb{P}(\text{went over})}$$

$$+ E[T_{\text{wait}} \mid \text{not over}] \cdot \mathbb{P}(\text{not over})$$

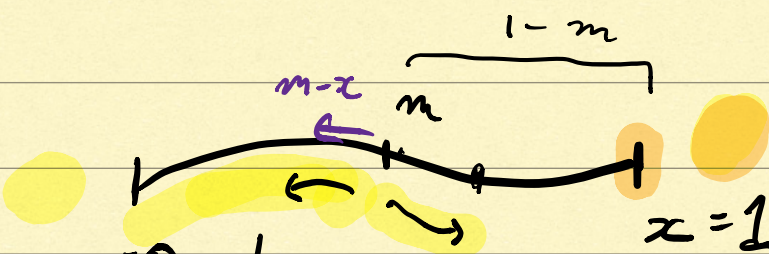
$$= \tau \cdot \mathbb{P}(T > 30 \text{ min})$$

$$+ 0 \cdot \mathbb{P}(T < 30 \text{ min})$$

$$= \tau \cdot (1 - F_T(30 \text{ min})) + 0$$

$$= \tau e^{-\frac{30}{30}} = \tau e^{-1} \approx 11 \text{ min}$$

B)



$$\tau = \text{erms} \frac{1}{nm}$$

$x=0$ \hookrightarrow R

$$\begin{aligned} \mathbb{P}(R=1) &= \mathbb{P}(R>1) \\ &= 1 - F_R(1-m) \\ &= e^{-\lambda(1-m)} \end{aligned}$$

$$\begin{aligned} \mathbb{P}(R>x) &= 1 - F_R(x-m) \\ m < x < 1 &= e^{-\lambda(x-m)} \end{aligned}$$

$$\begin{aligned} \mathbb{P}(\underline{L=0}) &= \mathbb{P}(L<0) = 1 - F_L(m) \\ &= 1 - 1 + e^{-\lambda m} = e^{-\lambda m} \end{aligned}$$

$$\begin{aligned} \mathbb{P}(\underline{L} < x) &= 1 - F_L(m-x) \\ &= e^{-\lambda(m-x)} \end{aligned}$$

$E[R]$

$$\begin{aligned} \text{WE EXPECT } n \rightarrow \infty \quad & E[R] \rightarrow m \\ & E[L] \rightarrow m \\ & E[R-L] \rightarrow 0 \end{aligned}$$

$$\begin{aligned} \text{AS } \lambda \rightarrow 0 \quad & E[R] \rightarrow 1 \\ & E[L] \rightarrow 0 \\ & E[R-L] \rightarrow 1 \end{aligned}$$

suppose
 $n=1$

$$E[R] = E[R | R < 1] P(R < 1) + E[R | R = 1] P(R = 1)$$

$$= \frac{E[R \cap R < 1]}{P(R < 1)} P(R < 1)$$

$$+ 1 \cdot P(R = 1)$$

$$= E[R \cap R < 1] + P(R = 1)$$

$$= \int_m^1 x p_R(x) dx + e^{-\lambda(1-m)}$$

$n > 1$

$E[R]$

$E[L]$