

ECE 139
SPRING 2005
FRIDAY 10A-12P DISCUSSION
QUIZ #5
29 APRIL 2005

NAME:

1. You go to the post office. Let X = the amount of time (in minutes) that you have to wait. X is a continuous random variable with the following density function:

$$f_X(x) = \begin{cases} k(e^{-x/3} + e^{-x/4}) & x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

- a. What is k ?
- b. What is the CDF, $F_X(x)$?
- c. What is $P[X \geq 5 \text{ minutes}]$?

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$$\textcircled{1} f_X(x) = \begin{cases} k(e^{-x/3} + e^{-x/4}) & x \geq 0 \\ 0 & \text{else} \end{cases}$$

② We know: $\int_0^{\infty} f_X(x) dx = 1$

$$\text{So } k \int_0^{\infty} (e^{-x/3} + e^{-x/4}) dx = -3k e^{-x/3} \Big|_0^{\infty} + -4k e^{-x/4} \Big|_0^{\infty}$$

$$= -3k(0-1) + -4k(0-1) = 7k = 1 \Rightarrow \boxed{k = \frac{1}{7}}$$

③ $F_X(x) = \int_0^x f_X(x) dx = \frac{1}{7} \int_0^x (e^{-x/3} + e^{-x/4}) dx$

$$\boxed{F_X(x) = \frac{1}{7} (7 - 3e^{-x/3} - 4e^{-x/4}) \quad x \geq 0} \quad \left(\begin{array}{l} \emptyset \\ \text{otherwise} \end{array} \right)$$

④ $P[X \geq 5] = 1 - P[X \leq 5] = 1 - F_X(5)$

$$= 1 - \frac{1}{7} (7 - 3e^{-5/3} - 4e^{-5/4})$$

$$= \boxed{\frac{1}{7} (3e^{-5/3} + 4e^{-5/4})}$$