Quiz 2

1. Suppose the pdf of the magnitude X of a dynamic load on a bridge is given by

$$f(x)=\begin{cases}\frac{1}{8}+\frac{3}{8}x, & 0\le x\le 2\\ 0, & otherwise\end{cases}$$

Find F(x), P(1⩽X⩽1.5) and P(X>1).

2 The following pdf of *X* is essentially the one suggested in "The Statistical Properties of Freeway Traffic".

$$f(x)=\begin{cases}0.15e^{-0.15(x-0.5)} & x\ge 0.5\\ 0 & otherwise\end{cases} \qquad (1)$$

(A) The formula (1) satisfy the pdf conditions?

(B) The probability that headway time is at most 5 sec is ?

3. Let *X* denote the number of creatures of a particular type captured in a trap during a given time period. Suppose that *X* has a Poisson distribution with λ=4.5, so on average traps will contain 4.5 creatures.

(A) What is the probability that a trap contains exactly five creatures?

(B) What is the probability that a trap has at most five creatures?

4. The breakdown voltage of a randomly chosen diode of a particular type is known to be normally distributed. What is the probability that a diode's breakdown voltage is within 1 standard deviation of its mean value?

5. A bank operates both a drive-up facility and a walk-up window. On a randomly selected day, let *X* = the proportion of time that the drive-up facility is in use, *Y* = the proportion of time that the walk-up window is in use. Let the joint pdf of (*X*,*Y*) be

$$f(x,y)=\begin{cases}\frac{6}{5}(x+y^2) & 0\le x\le 1, 0\le y\le 1\\ 0 & otherwise\end{cases}$$

(A) Determine the probability $P(0 \le X \le \frac{1}{4}, 0 \le Y \le \frac{1}{4})$

(B) Find $f_x(x)$ and $f_y(y)$

(C) X and Y are independent or not independent? why?

6. IQ in a particular population is known to be approximately normally distributed with μ = 100 and σ = 15. What is the probability that a randomly selected individual has an IQ of at least 125?

7. Suppose the response time X at a certain on-line computer terminal (the elapsed time between the end of a user's inquiry and the beginning of the system's response to inquiry) has an exponential distribution with expected response time equal to 5 sec.

（A） The probability that the response tine is at most 10 sec is

（B） The probability that response time is between 5 and 10 sec is

8. If X_1, …,X_n represent the lifetime of *n* components, the components operate independently of one another, and each lifetime is exponentially distributed with parameter λ.

(A) Joint pdf is?

(B) If there *n* components constitute a system that will fail as soon as a single component fails, then the probability that the system lasts past *t* time is?

9. The time that it takes a randomly selected rat of a certain subspecies to find its way through a maze is a normally distributed rv with μ = 1.5 min and σ = .35 min. Suppose five rats are selected. Let X_1, X_2, …, X_5 denote their times in the maze. Assuming the X_i's to be a random sample from this normal distribution.

（A）What is the probability that the total time $T_o = X_1+X_2+\ldots+X_5$ for the five is between 6 and 8 min?

（B）Determine the probability that the sample average time $\overline{X}$ is at most 2.0 min.

10. When a batch of a certain chemical product is prepared, the amount of a particular impurity in the batch is a random variable with mean value 4.0g and standard deviation 1.5g. If 50 batches are independently prepared, what is the (approximate) probability that the sample average amount of impurity X is between 3.5 and 3.8g?

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