Question: Let X = the time between two successive arrivals at the drive-…

(12 bookmarks)

Let X = the time between two successive arrivals at the drive-up window of a local bank. If X has an exponential distribution with ? = 1, (which is identical to a standard gamma distribution with ? = 1), compute the following. (If necessary, round your answer to three decimal places.)

(a) The expected time between two successive arrivals

(b) The standard deviation of the time between successive arrivals

(c) $P(X ? 4)$

(d) $P(3 ? X ? 5)$

Expert Answer

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General guidance

Concepts and reason

Exponential distribution: It explains about the time between events or distance between two random events. Moreover, the occurrence of the events is continuous and independent. Also, the average rate is constant.

Fundamentals

Let X be the continuous random variable with the parameter λ. Then, the probability density function X is,

$$f(x)=\begin{cases}\lambda e^{-\lambda x} & x>0\\ 0 & \text{elsewhere}\end{cases}$$

The cumulative distribution function of X is,

$$P(X\le x)=1-e^{-\lambda x}$$

Lack on memory property:

$$P(X>a+t\,|\,X>t)=P(X>a)\ \text{where}\ t>0\ \text{and}\ a>0$$

The formula for $P(X>x)$ is,

$$P(X>x)=1-P(X\le x)$$

Note: Units = Hours/minutes/seconds.

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Step-by-step

FIRST STEP | ALL STEPS | ANSWER ONLY

Step 1 of 4

(a)

The expected time between two successive arrivals is the mean of the distribution.

From the given information X has an exponential distribution with $\lambda=1$.

$$E(X)=\frac{1}{\lambda}$$
$$=\frac{1}{1}$$
$$=1$$

Part a

The expected time between two successive arrivals is 1unit.

Explanation | Common mistakes | Hint for next step

The expected time between two successive arrivals at the drive-up window of a local bank is 1unit. (Units = Hours/minutes/seconds).

Step 2 of 4

(b)
The standard deviation of the time between successive arrivals is computed as follows:

$$SD(X)=\frac{1}{\lambda}$$
$$=1(\text{since } \lambda=1)$$

Part b
The standard deviation of the time between successive arrivals is 1.

Explanation | Hint for next step

Approximately the deviation from the mean for two successive arrivals at the drive-up window of a local bank is 1 unit.

Step 3 of 4

(c)

Compute $P(X\le 4)$

$$P(X\le x)=1-e^{-\lambda x}$$
$$P(X\le 4)=1-e^{-1\times 4}$$
$$=1-e^{-4}$$
$$=1-0.0183$$
$$=0.9817$$

Part c
The probability that the time gap between two successive arrivals at the drive-up window of a local bank less than 4 units is **0.9817.**

Explanation | Hint for next step

There is 98.17% chance that the time gap between two successive arrivals at the drive-up window of a local bank for less than 4 units.

Step 4 of 4

(d)

Compute $P(3\le X\le 5)$

$$P(3\le X\le 5)=P(X\le 5)-P(X\le 3)$$
$$=\left(1-e^{-(1)(5)}\right)-\left(1-e^{-(1)(3)}\right)$$
$$=(1-0.0067)(1-0.0498)$$
$$=0.9933-0.9502$$
$$=0.0431$$

Part d
The probability between two successive arrivals from 3 and 5units at a bank door is 0.0431.

Explanation

The chance that, an arrival at the drive-up window of a local bank between 3 and 5 is 4.31%.

Answer

Part a
The expected time between two successive arrivals is 1unit.

Part b
The standard deviation of the time between successive arrivals is 1.

Part c
The probability that the time gap between two successive arrivals at the drive-up window of a local bank less than 4 units is **0.9817.**

Part d
The probability between two successive arrivals from 3 and 5units at a bank door is 0.0431.

Questions viewed by other students

Q: Let X denote the distance (m) that an animal moves from its birth site to the first territorial vacancy it encounters. Suppose that for banner-tailed kangaroo rats, X has an exponential distribution with parameter ? = 0.01327. (a) What is the probability that the distance is at most 100 m? At most 200 m? Between 100 and 200 m? (Round your answers to four decimal places...

A: See step-by-step answer 100% (11 ratings)

Q: A system consists of five identical components connected in series as shown: As soon as one components fails, the entire system will fail. Suppose each component has a lifetime that is exponentially distributed with ? = 0.01 and that components fail independently of one another. Define eventsAi = {ith component lasts at least t hours}, i = 1, . . . , 5, so that the Ais...

A: See step-by-step answer 100% (3 ratings)

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