

Student Information

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Answer 1

a) Since it is a uniform distribution, the probability density function is $f(x) = \frac{1}{b-a}$ where $b = 180$ and $a = 60$. Hence, $f(x) = \frac{1}{180-60} = \frac{1}{120}$

b) We know that mean of a uniform distribution is equal to $\frac{a+b}{2}$.
So, $E(x) = \mu = \frac{180+60}{2} = 120$

We know that variance of a uniform distribution is equal to $\frac{(b-a)^2}{12}$.
So, $Var(X) = \sigma^2 = \frac{(180-60)^2}{12} = 1200$

Standard deviation is the square root of variance.
So, $Std(X) = \sigma = \sqrt{1200} = 34.641$

c) We know that in the uniform distribution the probability is independent of the location of the interval. It is only dependent to its length. We see this after integrating density function. We get $\frac{h}{b-a}$ where h is the length of the interval.

Clearly, $P\{90 < X < 120\} = \frac{120-90}{180-60} = \frac{1}{4}$

d) This is a conditional probability. Let X be the the number of minutes it takes for the student to finish the homework.

$$P\{X > 150 \mid X > 120\} = \frac{P\{X > 120 \mid X > 150\} * P\{X > 150\}}{P\{X > 120\}} = \frac{1 * \frac{1}{4}}{\frac{1}{2}} = \frac{1}{2}$$

Answer 2

a) Since it is a binomial distribution;

$$E(X) = \mu = n * p = 500 * 0.02 = 10$$

$$Std(X) = \sigma = \sqrt{Var(X)} = \sqrt{n * p * (1 - p)} = \sqrt{500 * 0.02 * 0.98} = 3.130$$

b) Let X be the number of CP supporters in the sample. If we are going to use normal approximation to binomial distribution we need to first do continuity correction.

In the question we are asked : $P\{X < 8\}$. With continuity correction it becomes $P\{X < 7.5\}$. Now if we use normal approximation;

$$P\{X < 7.5\} = P\left\{\frac{X - 10}{3.13} < \frac{7.5 - 10}{3.13}\right\} = \Phi(-0.799) = 0.2121$$

c) We need to do continuity correction as we did in part b.

In the question we are asked : $1 - P\{X > 15\}$. With continuity correction it becomes $P\{X > 15.5\}$. Now if we use normal approximation;

$$1 - P\{X > 15.5\} = 1 - P\left\{\frac{X - 10}{3.13} < \frac{15.5 - 10}{3.13}\right\} = 1 - \Phi(1.757) = 0.0395$$

d) We need to do continuity correction as we did in part b, but this time to both sides. After we apply continuity correction to both side of the inequality it becomes;

$$\begin{aligned} P\{6.5 < X < 14.5\} &= P\left\{\frac{6.5 - 10}{3.13} < \frac{X - 10}{3.13} < \frac{14.5 - 10}{3.13}\right\} \\ &= \Phi(1.438) - \Phi(-1.118) = 0.9248 - 0.1318 = 0.7930 \end{aligned}$$

Answer 3

a) *We can use exponential distribution in this question. Cdf of exponential distribution is $F(X) = 1 - e^{-\lambda X}$*

We want the probability of no strikes within a year, so we need to subtract what we found from 1.

$$1 - F(X) = 1 - (1 - e^{-\lambda X}) = e^{-\lambda X} = e^{-1*1} = 0.3679$$

b) *The probability is the same since exponential distribution has memoryless property.*