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Answer 1

a.

$f(x) = \frac{1}{100-10} = \frac{1}{90}$
$P\{20 < I < 120\} = \int_{20}^{100} \frac{1}{90} = \frac{80}{90}$

b.

$E[X] = \int xf(x) = \int_{10}^{100} x\frac{1}{90} = \frac{x^2}{180}|_{100}^{10} = 55$

c.

$X^2 - 110X + 2800 = (X-40)(X-70) > 0$
$P\{20 < X < 40\} + P\{70 < X < 100\} = \frac{20}{90} + \frac{30}{90} = \frac{50}{90}$

d.

$\int f(x)dx = \int_{10}^{100} Cx = 1$
$\frac{Cx^2}{2}|_{10}^{100}$, $C = \frac{1}{4950}$
$E[X] = \int xf(x)dx = \int_{10}^{100} Cx^2dx = \frac{Cx^3}{3}|_{100}^{10} = \frac{999000}{14850} = 67$

Answer 2

a.

Probablity of the die comes up even number is the expected value for even.

$$\begin{aligned} E(X) &= \int xf(x)dx \\ &= \int_0^1 d^2e^dd(d) \\ &= e^x(x^2-2x+2)|_0^1 = e-2 \end{aligned} \tag{1}$$

b.

c.

Answer 3

Answer 4

The first sample moment is the sample mean which is

$$m_1 = \frac{1}{n}\sum_{i=1}^{n} X_i \tag{2}$$

which is in our case,

$$m_1 = \frac{1}{n}\sum_{i=1}^{n} a_i X_i \tag{3}$$

Answer 5

$$P(x) = e^{-\theta}\frac{\theta^x}{x!} \tag{4}$$

take *log* of both sides

$$lnP(x) = -\theta + xln\theta - ln(x!) \tag{5}$$

we need to maximize

$$lnP(X) = \Sigma_{i=1}^{n}(-\theta + X_i ln\theta) - \Sigma ln(x!) \tag{6}$$

to be able to maximize it we need to differentiate both sides with respect to θ and equating its derivative to 0.

$$\frac{\partial}{\partial\theta} lnP(X) = -n + \frac{1}{\theta}\Sigma_{i=1}^{n} X_i = 0 \tag{7}$$

This equation has only one solution,

$$\hat{\theta} = \frac{1}{n}\sum_{i=1}^{n} X_i = \hat{X} \tag{8}$$

Since this is the only solution, $\hat{\theta} = \hat{X}$.

Answer 6

a.

An estimator $\hat{\theta}$ is unbiased for a parameter θ if its expectation equals the parameter, since this is the case in question 5 it is unbiased.

b.