

姓名: 蒋嵩林 班级: 班级6 待批阅

## 一、简答题 (题数: 5, 共 100.0 分)

1 11.pdf

(20.0分)

我的答案

$$\begin{aligned} 1. X &\sim U(1, 2) \\ \Rightarrow P\{Y \leq y\} &= P\{e^{2X} \leq y\} = P\{X \leq \frac{1}{2} \ln y\} \\ \text{当 } \frac{1}{2} \ln y < 1, \text{ 即 } 0 < y < e^2 \text{ 时, } F_Y(y) &= 0 \\ \text{当 } \frac{1}{2} \ln y \geq 2 \text{ 即 } y > e^4 \text{ 时, } F_Y(y) &= 1 \\ \text{当 } e^2 \leq y \leq e^4 \text{ 时, } F_Y(y) &= \int_1^{\frac{1}{2} \ln y} 1 dy = \frac{1}{2} \ln y - 1 \\ \therefore F_Y(y) &= \begin{cases} 0 & 0 < y < e^2 \\ \frac{1}{2} \ln y - 1 & e^2 < y < e^4 \\ 1 & y > e^4 \end{cases} \\ f_Y(y) &= \begin{cases} \frac{1}{2y} & e^2 < y < e^4 \\ 0 & \text{其它} \end{cases} \end{aligned}$$

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(20.0分)

我的答案



$$2. (1) P\{\xi=0\} = \frac{1}{9}$$

$$P\{\xi=1\} = \frac{2}{9} + \frac{2}{9} = \frac{4}{9}$$

$$P\{\xi=2\} = \frac{2}{9} + \frac{1}{9} + \frac{1}{9} = \frac{4}{9}$$

$$\therefore \xi \sim \begin{pmatrix} 0 & 1 & 2 \\ \frac{1}{9} & \frac{4}{9} & \frac{4}{9} \end{pmatrix}$$

$$P\{\eta=0\} = \frac{1}{9} + \frac{2}{9} = \frac{3}{9} = \frac{1}{3}$$

$$P\{\eta=1\} = \frac{2}{9}$$

$$P\{\eta=2\} = \frac{1}{9}$$

$$P\{\eta=-1\} = \frac{2}{9}$$

$$P\{\eta=-2\} = \frac{1}{9}$$

$$\therefore \eta \sim \begin{pmatrix} -2 & -1 & 0 & 1 & 2 \\ \frac{1}{9} & \frac{2}{9} & \frac{1}{3} & \frac{2}{9} & \frac{1}{9} \end{pmatrix}$$

$$(2) X=0, Y=0 \Rightarrow \xi=0, \eta=0$$

$$X=0, Y=1 \Rightarrow \xi=1, \eta=-1$$

$$X=0, Y=2 \Rightarrow \xi=2, \eta=-2$$

$$X=1, Y=0 \Rightarrow \xi=1, \eta=1$$

$$X=1, Y=1 \Rightarrow \xi=2, \eta=0$$

$$X=2, Y=0 \Rightarrow \xi=2, \eta=2$$

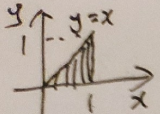
$$\Rightarrow$$

$\xi \backslash \eta$	0	1	2
-2	0	0	$\frac{1}{9}$
-1	0	$\frac{2}{9}$	0
0	$\frac{1}{9}$	0	$\frac{2}{9}$
1	0	$\frac{2}{9}$	0
2	0	0	$\frac{1}{9}$

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(20.0分)

我的答案

3. 

$$EX = \int_0^1 dx \int_0^x x \cdot 2y^2 dy = \frac{4}{5}$$

$$EXY = \int_0^1 dx \int_0^x x \cdot 2y^3 dy = \frac{1}{2}$$

$$E(X^2 + Y^2) = EX^2 + EY^2 = \int_0^1 dx \int_0^x x^2 \cdot 2y^2 dy + \int_0^1 dx \int_0^x y^2 \cdot 2y^2 dy$$

$$= \frac{2}{3} + \frac{2}{5} = \frac{16}{15}$$

$$DX = EX^2 - (EX)^2 = \frac{2}{3} - \frac{16}{25} = \frac{2}{25}$$

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(20.0分)

我的答案





4.  $X \sim B(10000, 0.7) \Rightarrow EX = 7000, DX = 2100$   
由中心极限定理得

$$\begin{aligned} & P\{6800 \leq X \leq 7200\} \\ &= P\left\{\frac{6800-7000}{\sqrt{2100}} \leq \frac{X-7000}{\sqrt{2100}} \leq \frac{7200-7000}{\sqrt{2100}}\right\} \\ &= \Phi\left(\frac{7200-7000}{\sqrt{2100}}\right) - \Phi\left(\frac{6800-7000}{\sqrt{2100}}\right) \\ &= \Phi\left(\frac{20}{\sqrt{21}}\right) - \Phi\left(-\frac{20}{\sqrt{21}}\right) = 2\Phi\left(\frac{20}{\sqrt{21}}\right) - 1 \approx 1 \end{aligned}$$

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(20.0分)

我的答案

$$\begin{aligned} 5. (1) Y &= \frac{(X_1 + X_2)^2}{(X_3 - X_4)^2} & E(X_1 + X_2) &= 0 & D(X_1 + X_2) &= 26^2 \\ & & E(X_3 - X_4) &= 0 & D(X_3 - X_4) &= 26^2 \end{aligned}$$

$$\therefore \text{原式} = \frac{\left(\frac{X_1 + X_2 - 0}{\sqrt{26^2}}\right)^2 / 1}{\left(\frac{X_3 - X_4 - 0}{\sqrt{26^2}}\right)^2 / 1} \Rightarrow Y \sim F(1, 1)$$

自由度为1, 1

$$(2) X' = \frac{(X_3 - X_4)}{\sqrt{\sum_{i=1}^2 (X_i - 14)}} = \frac{(X_3 - X_4)^2}{\sqrt{\sum_{i=1}^2 (X_i - 14)^2}} = \frac{X}{\sqrt{\frac{Y}{2}}}$$

$$\begin{aligned} X &\sim N(0, 1) & Y &\sim \chi^2(2) \\ \therefore X' &= t(2) & \text{自由度为 } 2 \end{aligned}$$

