4 (1)

$$P\{X=k\}=p(1-p)^{k-1}, k=1,2,3,\cdots$$

(2)

$$P\{Y=k\}=C_{k-1}^{r-1}p^r(1-q)^{k-r}, k=r,r+1,\cdots$$

(3)

- $$P\{X=k\}=0.45(0.55)^{k-1}, k=1,2,3,\cdots$$

- $$\begin{aligned} P &= \sum_{k=1}^{\infty} P\{X=2k\} \\ &= 0.45(0.55)+0.45(0.55)^3+0.45(0.55)^5+\cdots \\ &= 0.45(\sum_{k=1}^{\infty} 0.55^{2k-1}) \\ &= 11/31 \end{aligned}$$

18 Uniform distribution

$$F(x)=\begin{cases} 0, & x<0 \\ \frac{x}{a}, & 0\leqslant x<a, \\ 1, & x\geqslant a \end{cases}$$

20 (1)

- $P\{X<2\}$

$$\begin{aligned} P\{X<2\} &= F(2) \\ &= F(2)-F(-\infty) \\ &= ln2 \end{aligned}$$

- $P\{0<X\leqslant 3\}$

$$\begin{aligned} P\{0<X\leqslant 3\} &= F(3)-F(0) \\ &= 1-0 \\ &= 1 \end{aligned}$$

- $P\{2<X<5/2\}$

$$\begin{aligned} P\{2<X<5/2\} &= F(5/2)-F(2) \\ &= ln(5/2)-ln2 \\ &= ln(5/4) \end{aligned}$$

(2) Derivatives of CDF

$$f(x)=\begin{cases} \frac{1}{x}, & 1<x<\mathrm{e} \\ 0, & \text{其他}. \end{cases}$$

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- $t=h(\theta)=\frac{9}{5}\theta+32$
- $t^{'}=h^{'}(\theta)=\frac{9}{5}$

- $$f_T(t) = \frac{1}{\sqrt{4\pi}} Exp(-\frac{(t-98.6)}{4})$$

- $$\begin{aligned} f_T(h(\theta))|h^{'}(\theta)| &= \frac{1}{2\sqrt{\pi}} Exp(-\frac{(\frac{9}{5}\theta + 32 - 98.6)^2}{4})\frac{9}{5} \\ &= \frac{9}{10\sqrt{\pi}} Exp(-\frac{81}{100}(\theta - 37)^2) \end{aligned}$$