

1. (a) Continuous random variable: Takes any value in an interval  
e.g. temperature.

(i) Expectation: The average value you expect.

$$\text{Formula: } E(X) = \sum x \cdot P(x)$$

(b) Can experiment

Flip a coin

•  $X = 1$  if Heads,  $X = 0$  if Tails

•  $P(X=1) = 0.5$ ,  $P(X=0) = 0.5$

It's random because we can't predict it

(c) Die game

•  $X = 2$  (if 1),  $X = 1$  (if 6),  $X = -1$  (if 2-5)

•  $P(X=2) = 1/6$ ,  $P(X=1) = 1/6$ ,  $P(X=-1) = 4/6$

•  $E(X) = -1/6 \approx -0.167 \rightarrow$  You lose on average

(d) Given PDF:  $f(x) = 3.6x - 2.4x^2$  for  $0 < x < 1$

• Mean = 0.6

• Variance = 0.06

•  $P(X > 0.5) = 0.65$

• Median:  $\sim 0.63$

2 (a) Flight overbooking

110 tickets, 100 seats

$P(\text{more show up}) \sim 0.96$

(b) Poisson claims

$\lambda = 2 \rightarrow \text{std dev} = \sqrt{2} = 1.41$

(c) 75 defective fans

$\lambda = 32$  (from  $800 \times 0.04$ )

$P(X = 75) \approx 0$  (very small)

(d) Accidents (Poisson  $\lambda = 2$ )

i)  $P(1 \text{ day}) = 0.2707$

ii)  $P(0-2 \text{ days}) = 0.6767$



e) claim size

$$\text{Mean} = 53 \cdot \text{SD} = 18.5$$

$$\text{Range} = (34.5, 71.5)$$

$$\% \text{ within } \pm \text{SD} = 45\%$$

(+)

Geometric ( $p = 0.05$ )

$$E(x) = 20$$

$$P(x \leq 3) = 0.045$$

$$P(x \leq 5) = 0.226$$

$$P(x > 10) = 0.599$$

(9)

Negative Binomial ( $r=3, p=0.2$ )

$$P(x=10) = 0.060$$

$$P(x \leq 12) = 0.857$$

$$\text{Variance} = 60$$