

**1 If we roll a fair die, what is the probability that after 6 rolls we:**

**1.a Do not get a 6?**

$$P(A^c) = \left(\frac{5}{6}\right)^6$$

**1.b Get a 6 on the first roll, but not after?**

$$P(A) = \frac{1}{6} * \left(\frac{5}{6}\right)^5$$

**1.c Get Exactly one 6**

$$P(A) = \left(\frac{5}{6}\right)^5$$

**2 Suppose you roll 2 fair six sided dice.**

**2.a Find P(A) and P(B)**

$$P(A) = \frac{15}{36}$$
$$P(B) = \frac{8}{36} = \frac{2}{9}$$

**2.b**

$$P(A \cap B) = P(A) * P(B)$$
$$P(A \cap B) = \frac{2}{36} = \frac{1}{18}$$
$$P(A) * P(B) = \frac{15}{36} * \frac{2}{9}$$
$$P(A \cap B) \neq \frac{5}{54}$$

Not independent

**2.c**

$$P(A \bigcup B \text{ 25 \% of time}) = \frac{19}{36} * P(A^c \bigcup B^c) \\ 4 * \frac{19}{36} * \left(\frac{17}{36}\right)^3$$

**3**

**3.a**

$$S = \{TTT, TTH, THH, HHH\} \\ X = \{-6, 1 - 4, 4 - 2, 9\} \\ X = \{-6, -3, 2, 9\}$$

**3.b Find probability mass density**

$$p(-6) = \frac{1}{8} * -6 = \frac{-6}{8} \\ p(-3) = \frac{3}{8} * -3 = \frac{-9}{8} \\ p(2) = \frac{3}{8} * 2 = \frac{6}{8} \\ p(9) = \frac{1}{8} * 9 = \frac{9}{8} \\ E = 0$$

**3.c E**

$$E(x) = \frac{-6}{8} - \frac{-9}{8} + \frac{6}{8} + \frac{9}{8} = 0$$

**4**

**4.a**

$$\begin{aligned} S &= \{3, 4, 5\} \\ p(3) &= \frac{1}{10} * \frac{2}{9} = \frac{2}{90} \\ p(4) &= \frac{8}{45} \end{aligned}$$