

### Question 1

a) Sample space is:

$$S = \{HHH, HTH, HHT, HTT, TTH, TTH, THT, TTT\}$$

b) “More heads than tails” =  $\{HHH, HTH, HHT, TTH\}$ .

$$\Pr(\text{More heads than tails}) = \frac{4}{8} = \frac{1}{2}.$$

c) “Two tails” =  $\{HTT, TTH, THT\}$ .

$$\Pr(\text{Two tails}) = \frac{3}{8}.$$

### Question 2

$$\begin{aligned} \text{a) } \Pr(W \cup M) &= \Pr(W) + \Pr(M) - \Pr(W \cap M) \\ &= 0.7 + 0.2 - 0.1 = 0.8. \end{aligned}$$

$$\begin{aligned} \text{b) } \Pr(W^c \cap M^c) &= 1 - \Pr(W \cup M) \\ &= 1 - 0.8 = 0.2. \end{aligned}$$

c)  $W$  and  $M$  are *not* mutually exclusive since  $\Pr(W \cap M) \neq 0$ .

$$\begin{aligned} \text{d) } \Pr(W) \times \Pr(M) &= 0.7 \times 0.2 \\ &= 0.14 \\ &\neq \Pr(W \cap M) = 0.1. \\ &\Rightarrow \text{not independent.} \end{aligned}$$

### Question 3

$$\text{a) } \Pr(A \cup B) = \Pr(A) + \Pr(B) - \Pr(A \cap B)$$

$$0.75 = 0.45 + 0.6 - \Pr(A \cap B)$$

$$0.75 = 1.05 - \Pr(A \cap B)$$

$$0.75 - 1.05 = -\Pr(A \cap B)$$

$$-0.3 = -\Pr(A \cap B)$$

$$\Rightarrow \Pr(A \cap B) = 0.3.$$

$$\text{b) } \Pr(A) \times \Pr(B) = 0.45 \times 0.6$$

$$= 0.27$$

$$\neq \Pr(A \cap B) = 0.3.$$

$$\Rightarrow \text{not independent.}$$

$$\text{c) } \Pr(A^c) = 1 - \Pr(A) = 1 - 0.45 = 0.55.$$

$$\Pr(B^c) = 1 - \Pr(B) = 1 - 0.6 = 0.4.$$

$$\text{d) Note that } (A \cap B)^c = A^c \cup B^c.$$

$$\Rightarrow \Pr(A^c \cup B^c) = 1 - \Pr(A \cap B)$$

$$= 1 - 0.3$$

$$= 0.7.$$

### Question 4

For solutions to Question 8 see the solutions of Q3 and Q5 of Lecture3.

### Question 5

The solution to this question is in Lecture4 solutions (i.e., Q2 of Lecture4).