

# BASIC PROBABILITY CONCEPTS

$$1. A = \text{Walking} \quad B = \text{Biking} \quad P(A) = 0.8 \quad P(B) = 0.6 \quad P(A \cup B) = 1$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \quad 1 = 0.8 + 0.6 - P(A \cap B) \Rightarrow P(A \cap B) = 0.4$$

$$P(B) = P(B \cap A) + P(B \cap A') \Rightarrow 0.6 = 0.4 + P(B \cap A') \quad \underline{P(B \cap A') = 0.2}$$

$$2. A = \text{Chiropractor} \quad B = \text{PT} \quad P(A \cap B) = 0.22 \quad P(A' \cap B') = 0.12 \quad P(A) = P(B) + 0.14$$

$$P(B) = ? \quad 1 - P(A' \cap B') = P(A \cup B) = 1 - 0.12 = 0.88 \quad P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$\Rightarrow 0.88 = P(B) + 0.14 + P(B) - 0.22 \quad 2P(B) = 0.88 - 0.14 + 0.22 = 0.96 \quad \underline{P(B) = 0.48}$$

$$3. P(A) = \frac{1}{4} \quad P(B) = \frac{1}{3} \quad P(C) = \frac{5}{12} \quad P(N) = ? \quad P(A) = P(B \cap A) + P(C \cap A) = \frac{1}{4}$$

$$P(B) = P(B \cap A) + P(C \cap B) = \frac{1}{3} \quad P(C) = P(C \cap B) + P(C \cap A) = \frac{5}{12} \quad P(B \cap A) = \frac{1}{4} - P(C \cap A)$$

$$P(B) = \frac{1}{4} - P(C \cap A) + P(C \cap B) = \frac{1}{3} \quad -P(C \cap A) + P(C \cap B) = \frac{1}{12} \quad \begin{bmatrix} -1 & 1 & 1/2 \\ 1 & 1 & 5/12 \end{bmatrix} \rightarrow \begin{bmatrix} 0 & 2 & 1/2 \\ 1 & 1 & 5/12 \end{bmatrix}$$

$$P(C \cap B) = \frac{1}{4} \quad -P(C \cap A) + \frac{1}{4} = \frac{1}{12} \quad P(C \cap A) = \frac{1}{6} \quad P(B \cap A) = \frac{1}{4} - \frac{1}{6} = \frac{1}{12}$$

$$P(A \cap B) + P(A \cap C) + P(B \cap C) = \frac{1}{12} + \frac{1}{6} + \frac{1}{4} = \frac{1}{2}$$

$$P(N) = 1 - (P(A \cap B) + P(A \cap C) + P(B \cap C)) = 1 - \frac{1}{2} = \frac{1}{2} \quad P(N) = \frac{1}{2}$$

$$4. P(\text{Young}) = \frac{3000}{10,000} = 0.3 \quad P(\text{Male}) = \frac{4600}{10,000} = 0.46 \quad P(\text{Married}) = \frac{7000}{10,000} = 0.7$$

$$P(\text{Young} \cap \text{Male}) = \frac{1320}{10,000} = 0.132 \quad P(\text{Married} \cap \text{Male}) = \frac{3010}{10,000} = 0.301 \quad P(\text{Young} \cap \text{Married}) = \frac{1462}{10,000} = 0.14$$

$$P(\text{Young} \cap \text{Married} \cap \text{Male}) = \frac{600}{10,000} = 0.06 \quad P(\text{Young} \cap \text{Female} \cap \text{Single}) = ?$$

$$P(\text{Young}) = P(\text{Young} \cap \text{Male}) \cup P(\text{Young} \cap \text{Female}) \Rightarrow 0.3 = 0.132 + P(\text{Young} \cap \text{Female})$$

$$P(\text{Young} \cap \text{Female}) = 0.168$$

$$P(\text{Young} \cap \text{Married}) = P(\text{Young} \cap \text{Married} \cap \text{Male}) \cup P(\text{Young} \cap \text{Married} \cap \text{Female}) \Rightarrow 0.14 = 0.06 + P(\text{Young} \cap \text{Married} \cap \text{Female})$$

$$P(\text{Young} \cap \text{Married} \cap \text{Female}) = 0.08$$

$$P(\text{Young} \cap \text{Female}) = P(\text{Young} \cap \text{Married} \cap \text{Female}) \cup P(\text{Young} \cap \text{Single} \cap \text{Female}) \Rightarrow 0.168 = 0.08 + P(\text{Young} \cap \text{Single} \cap \text{Female})$$

$$P(\text{Young} \cap \text{Single} \cap \text{Female}) = 0.088 \quad 880 \text{ young single females}$$

$$5. A = \text{Lab work} \quad B = \text{Specialist} \quad P(A' \cap B') = 0.35 \quad P(A) = 0.4 \quad P(B) = 0.3$$

$$P(A \cup B) = 1 - P(A' \cap B') = 1 - 0.35 = 0.65 \quad P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$0.65 = 0.4 + 0.3 - P(A \cap B) \quad P(A \cap B) = 0.05$$

$$6. P(A \cup B) = 0.7 \quad P(A \cup B') = 0.9 \quad P(A) = ? \quad P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A \cup B') = P(A) + P(B') - P(A \cap B') \quad P(A) = P(A \cap B) + P(A \cap B')$$

$$P(A \cup B') + P(A \cup B) = P(A) + P(B') - P(A \cap B') + P(A) + P(B) - P(A \cap B)$$

$$P(A \cup B') + 0.7 = 2P(A) + P(B') + P(B) - P(A) \Rightarrow 1.6 = P(A) + P(B') + P(B)$$

$$P(B') + P(B) = 1 \quad 0.6 = P(A)$$

7.  $P(G) = 0.28$   $P(B) = 0.29$   $P(S) = 0.19$   $P(G \cap B) = 0.14$   $P(B \cap S) = 0.12$

$P(G \cap S) = 0.1$   $P(G \cap S \cap B) = 0.08$

$P(G' \cap B' \cap S') = P(G \cap S \cap B)^c = 1 - 0.12 - 0.11 - 0.05 - 0.06 - 0.04 - 0.02 - 0.08 = 1 - 0.48 = 0.52$

