

# 第三章 機率基礎概念

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## 第 3.2 節 機率的定義

※ 機率(probability)：測度樣本空間中各個事件發生的機會。

隨機試驗的機率  $P$  必須滿足以下條件：

1.  $A \subseteq \Omega, P(A) \geq 0$
2.  $P(\Omega) = 1$
3.  $A_1, A_2, \dots$  為互斥事件

$$\Rightarrow P(A_1 \cup A_2 \cup A_3 \dots) = \sum_{i=1}^{\infty} P(A_i)$$

## Notes:

$$1. \quad A \subseteq B \Rightarrow P(A) \leq P(B)$$

$$\because B = \underbrace{A}_{\text{互斥事件}} \cup \underbrace{(B \setminus A)}_{\text{互斥事件}}$$

$$\Rightarrow P(B) = P(A) + P(B \setminus A)$$

$$\Rightarrow P(B) \geq P(A)$$

$$2. \quad A \subseteq \Omega, \quad 0 \leq P(A) \leq 1$$

$$\therefore 0 \leq P(A) \leq \underbrace{P(\Omega)}_{=1}$$

$$\Rightarrow 0 \leq P(A) \leq 1$$

$$3. P(A^c) = 1 - P(A)$$

$$\because A \cup A^c = \Omega$$

$$\Rightarrow P(A \cup A^c) = P(\Omega)$$

$$P(A) + P(A^c) = 1$$

$$\Rightarrow P(A^c) = 1 - P(A)$$

$$4. P(\phi) = P(\Omega^c) = 1 - P(\Omega) = 1 - 1 = 0$$

$$5. P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$\Rightarrow$  兩個事件的加法法則 (addition rule)

$$A \cup B = A \cup (B \setminus A)$$

$$= A \cup (B \cap A^c)$$

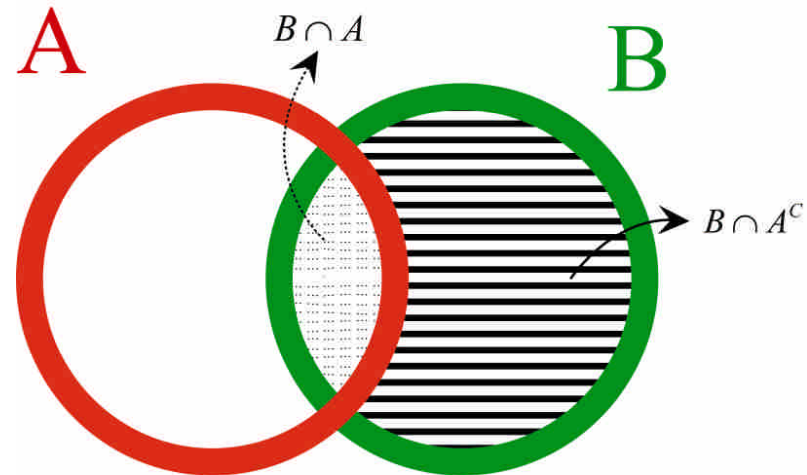
$$P(A \cup B) = P(A) + P(B \cap A^c)$$

$$\because B = (B \cap A) \cup (B \cap A^c)$$

$$\Rightarrow P(B) = P(B \cap A) + P(B \cap A^c)$$

$$\therefore P(B \cap A^c) = P(B) - P(A \cap B)$$

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



**定理 3.9:**  $A, B \subseteq \Omega$ , 則  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ . 若  $A, B$  互斥, 則  $P(A \cup B) = P(A) + P(B) - P(\phi) = P(A) + P(B)$ .