# Probability Theory

## Conditional Probability

Section 5.2

# General multiplication rule

- A **conditional probability**, $P(B \mid A)$, is the probability of some event, $B$, under the condition that some other event, $A$, has definitely occurred

- **General multiplication rule:**

$$P(A \text{ and } B) = P(A)\ P(B \mid A)$$

- Extended version for multiple events:

$$P(A \text{ and } B \text{ and } C) = P(A)\ P(B \mid A)\ P(C \mid A \text{ and } B)$$

*etc.*

# Implications of the general multiplication rule

- A **definition of conditional probability** is

$$P(B \mid A) = P(A \text{ and } B) \,/\, P(A)$$

To derive: rearrange the general multiplication rule

- If $A$ and $B$ are independent, $P(A \text{ and } B) = P(A)\ P(B)$, hence

$$P(B \mid A) = P(B)$$