

Section 1

MANE 3332.04

Subsection 1

Lecture 5, February 10

Agenda

- Continue Chapter 2 lecture
- **New: Single Event Quiz (assigned 2/10/2025, due 2/12/2025)**
- **New: Two Events Practice Problems (assigned 2/10/2025, due 2/12/2025)**
- Calculators
- Attendance

Handouts

- Lecture 5 Slides
- Lecture 5 Marked Slides

Conditional Probability

- Hayter (2002) states that “For experiments with two or more events of interest, attention is often directed not only at the probabilities of individual events but also at the probability of an event occurring **conditional** on the knowledge that another event has occurred.”
- The **conditional probability** of an event B given an event A , denoted $P(B|A)$ is

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

for $P(A) > 0$

- Consider problems 2-99

Two Events Practice Problems

Multiplication Rules

- This rule provides another method for calculating $P(A \cap B)$

$$P(A \cap B) = P(A|B)P(B) = P(B|A)P(A)$$

- This leads to the total probability rule

$$\begin{aligned} P(B) &= P(B \cap A) + P(B \cap A') \\ &= P(B|A)P(A) + P(B|A')P(A') \end{aligned}$$

- Consider problems from 3rd edition (next slide) and 2-129

Example Problem 2-76

problem 2-76

Independent Events

- Two events are independent if any one of the following is true:
 - ① $P(A|B) = P(A)$
 - ② $P(B|A) = P(B)$
 - ③ $P(A \cap B) = P(A)P(B)$
- Consider problem 2-146

Reliability Analysis

- Reliability is the application of statistics and probability to determine the probability that a system will be working properly
- Components can be arranged in series. All components must work for the system to work.

$$P(\text{system works}) = P(A \text{ works})P(B \text{ works})$$

- Components can be arranged in parallel. As long as one component works, the system works.

$$P(\text{system works}) = 1 - (1 - P(A \text{ works})) \times 1 - P(B \text{ works}))$$

- Consider problem 2-157