

Joshua Reed  
Fall, 2017

# Homework 1

## MTH 361 - Introduction to Probability

### 1.7 #3

#### Exercise

Two students pick a tire of four. What is the chance that they pick the same tire?

#### Solution

**Sample space for one student.**

The sample space is  $\{1,2,3,4\}$ .

Thus the chance that either picks any one tire is  $1/4$ .

**Sample space for one student then the other.**

The sample space is:

$$\begin{aligned}\Omega = \{ & (1, 1), (1, 2), (1, 3), (1, 4), \\ & (2, 1), (2, 2), (2, 3), (2, 4), \\ & (3, 1), (3, 2), (3, 3), (3, 4), \\ & (4, 1), (4, 2), (4, 3), (4, 4) \}\end{aligned}$$

**The event in which they pick the same tire.**

$$E = \{(1, 1), (2, 2), (3, 3), (4, 4)\}$$

**Probability they pick the same tire.**

There are 4 ways to pick the same tire and 16 total ways to pick tires.

$$\begin{aligned}P(\text{same}) &= \frac{4}{16} \\ &= \frac{1}{4}\end{aligned}$$

## 1.7 #15

### Exercise

24% have American Express cards, 61% have visa, and 8% have both. What percent have at least one credit card?

### Solution

Having at least one card is the union of those with either card.

$$\begin{aligned}P(\geq 1 \text{ card}) &= P(AE) \cup P(V) \\&= P(AE) + P(V) - P(AE \cap V) \\&= 24\% + 61\% - 8\% \\&= 77\end{aligned}$$

## 1.7 #25

### Exercise

Alice attends 60%, Betty attends 80%. Their attendance is independent. What is the chance that at least one is there on a given day. What is the chance that exactly one is there?

### Solution

Rule for the intersection of independent events.

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

Probability they both attend

$$P(A \cap B) = .6 * .8 = .48$$

Probability either attends is the probability of the union of the two events.

$$\begin{aligned}P(A \cup B) &= P(A) + P(B) - P(A \cap B) \\&= .6 + .8 - .48 \\&= .92\end{aligned}$$

**The probability that exactly one attends.**

This is the probability that either attends minus the probability of both attending.

$$\begin{aligned}P(1) &= P(\geq 1) - P(A \cap B) \\&= .92 - .48 \\&= .44\end{aligned}$$

## 1.7 #26

### Exercise

A and B are independent events  $P(A) = 0.4$   $P(A \cup B) = 0.64$  What is  $P(B)$ ?

### Solution

**Rule of independent events.**

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

**Probability of either events happening.**

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

**Relating the two above equations.**

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

**Solve**

$$0.64 = 0.4 + P(B) - (0.4)P(B)0.24 = P(B) - (0.4)P(B)0.24 = (1 - 0.4)P(B)0.24 = (0.6)P(B)P(B) =$$

The distribution of  $|X - Y|$

