

Independence

- Independence of two events means that the outcome of one event does not influence the probability of the other.
- With our new notation for conditional probabilities, we can now formalize this definition:
 - Events **A** and **B** are **independent** whenever $P(\mathbf{B}|\mathbf{A}) = P(\mathbf{B})$. (Equivalently, events **A** and **B** are independent whenever $P(\mathbf{A}|\mathbf{B}) = P(\mathbf{A})$.)

Independent \neq Disjoint

- Disjoint events *cannot* be independent! Well, why not?
 - Since we know that disjoint events have no outcomes in common, knowing that one occurred means the other didn't.
 - Thus, the probability of the second occurring changed based on our knowledge that the first occurred.
 - It follows, then, that the two events are *not* independent.
- A common error is to treat disjoint events as if they were independent, and apply the Multiplication Rule for independent events—don't make that mistake.

Independent \neq Disjoint

- Two events could be either independent or disjoint, *but not both*.
- And they could be *neither* disjoint not independent.

Are "red card" and "spade" Independent?

Mutually exclusive (disjoint)?

$$P(\text{Red}) = P(\text{Red} | \text{Spade})$$

$$\frac{1}{2} \neq 0 \quad \underline{\text{Not independent}}$$

Can't be "red" and "spade" (No Both)

\therefore Disjoint

Are "red card" and "ace" independent?

Mutually exclusive?

$$P(\text{Red}) = P(\text{Red} | \text{Ace})?$$

$$\frac{1}{2} = \frac{2}{4}$$

$$\frac{1}{2} = \frac{1}{2} \therefore \text{Independent}$$

Can have a Red Ace (Both)
 \therefore Not Disjoint (M.E.)

Are "face card" and "king" independent?

Mutually exclusive?

$$P(\text{Face}) = P(\text{Face} | \text{King}) ?$$

$$12/52 = 4/13$$

$$12/52 \neq 1/4 \quad \underline{\text{Not independent}}$$

Can be Both (Face and King)
 \therefore Not M.E. (not Disjoint)

Homework:
Packet pg. 6
Book # 26 and 27

on the front

5. Use the table to decide whether or not these variables are independent. Explain.

$P(\text{yes}) = P(\text{yes}|\text{Female})?$

6. You repeat this survey in another class of 24 students and find six of the nine females intend to buy online and 11 males do not intend to buy. Organize these responses in the table and show whether sex and buying intentions are independent in this class.

		Intend to Buy		
		Yes	No	Total
Sex	Male			
	Female			
	Total			