Topic 13:

Finite Probability

Probability (1 / 2)

Definition: Probability

- The occurrences of interest are called _____.
- The set of possible occurrences is the _____.
- These are finite sets, hence the term *finite* probability.
- The occurrence probability of an interest event:

Probability (2 / 2)

Please note: (a) $\forall e \in S,\ p(e) > 0$ (b) $\sum_{e \in S} p(e) = 1$

Example(s):

Applications of Counting to Probability (1 / 2)

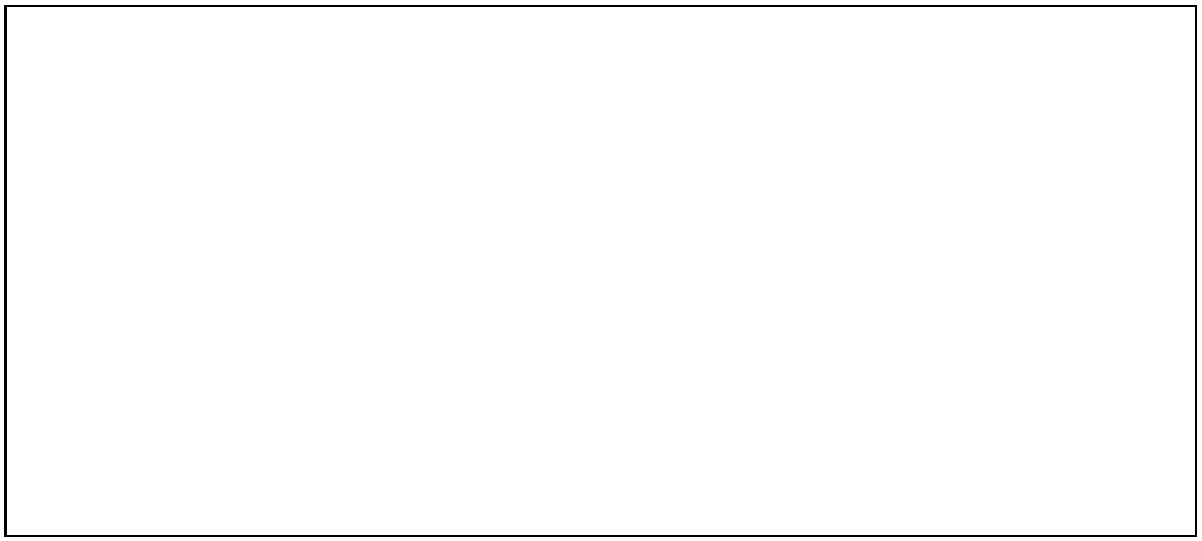
1. Probability of Winning the Powerball Lottery

Applications of Counting to Probability (2 / 2)

2. Principle of Inclusion-Exclusion

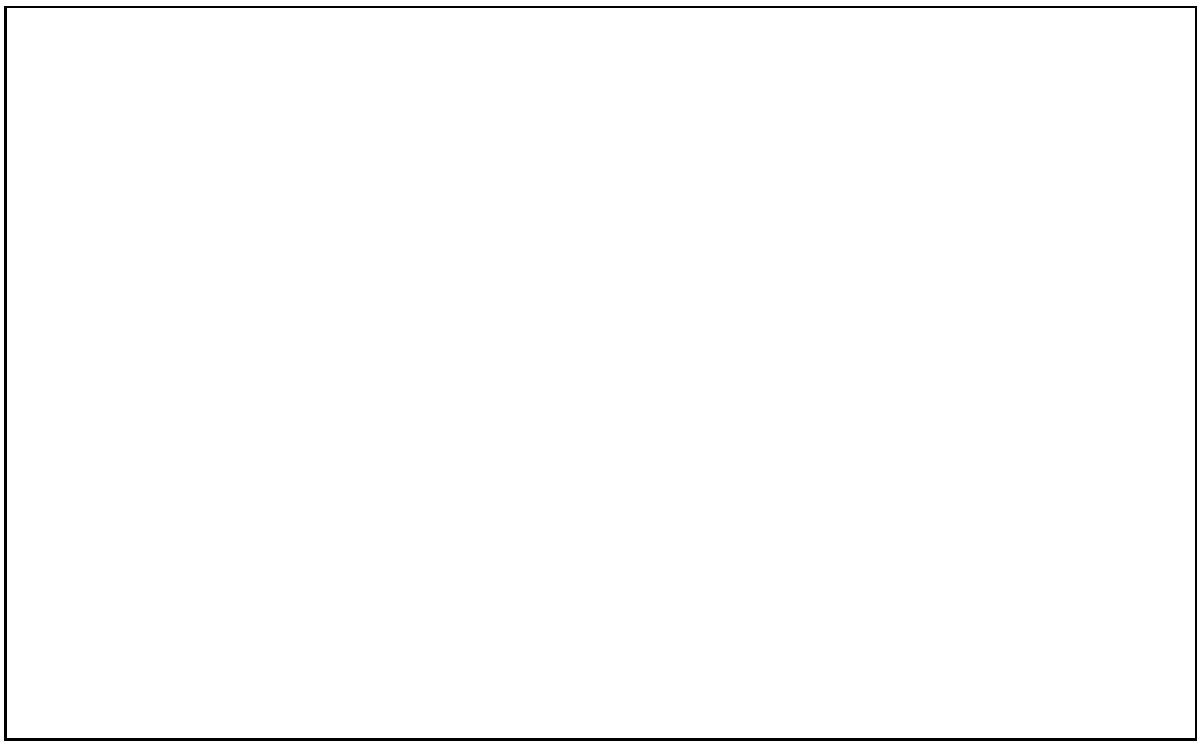
Recall: $|E_1 \cup E_2| = |E_1| + |E_2| - |E_1 \cap E_2|$

Example(s):



Conditional Probability (1 / 2)

Example(s):



Conditional Probability (2 / 2)

Definition: Conditional Probability

Example(s):

Independence of Events (1 / 3)

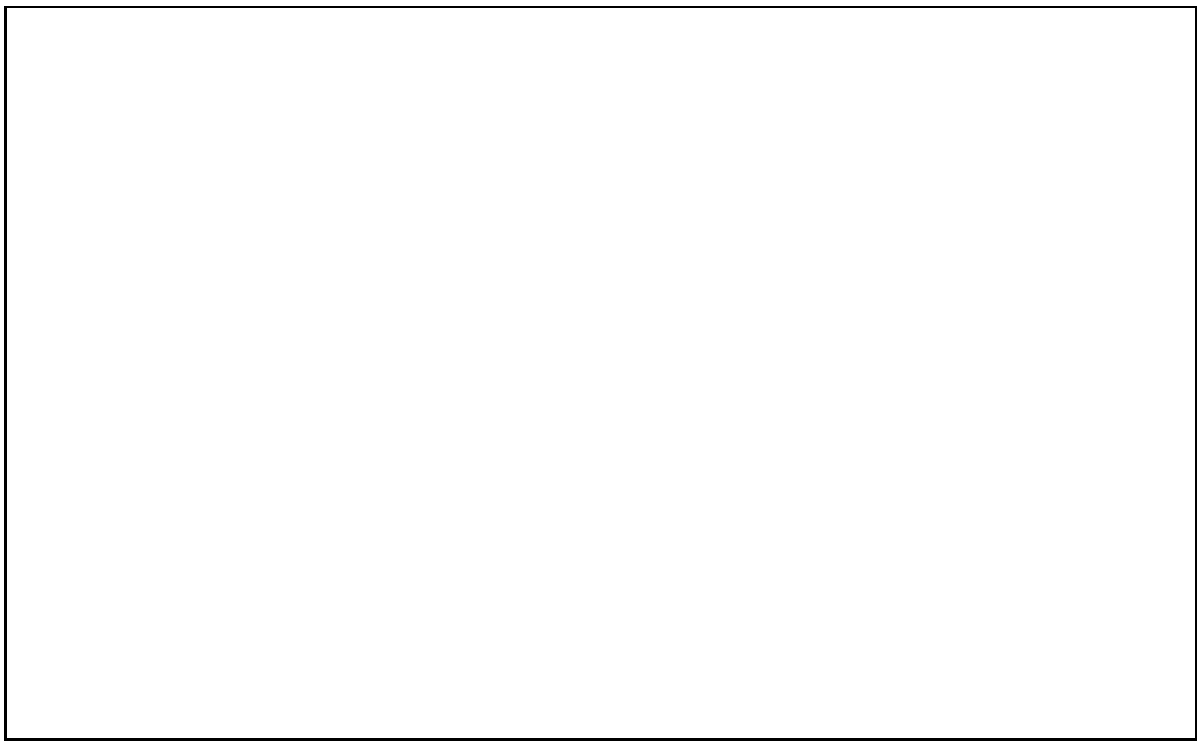
Recall: $p(A|B) = \frac{p(A \cap B)}{p(B)}$

Definition: Independent

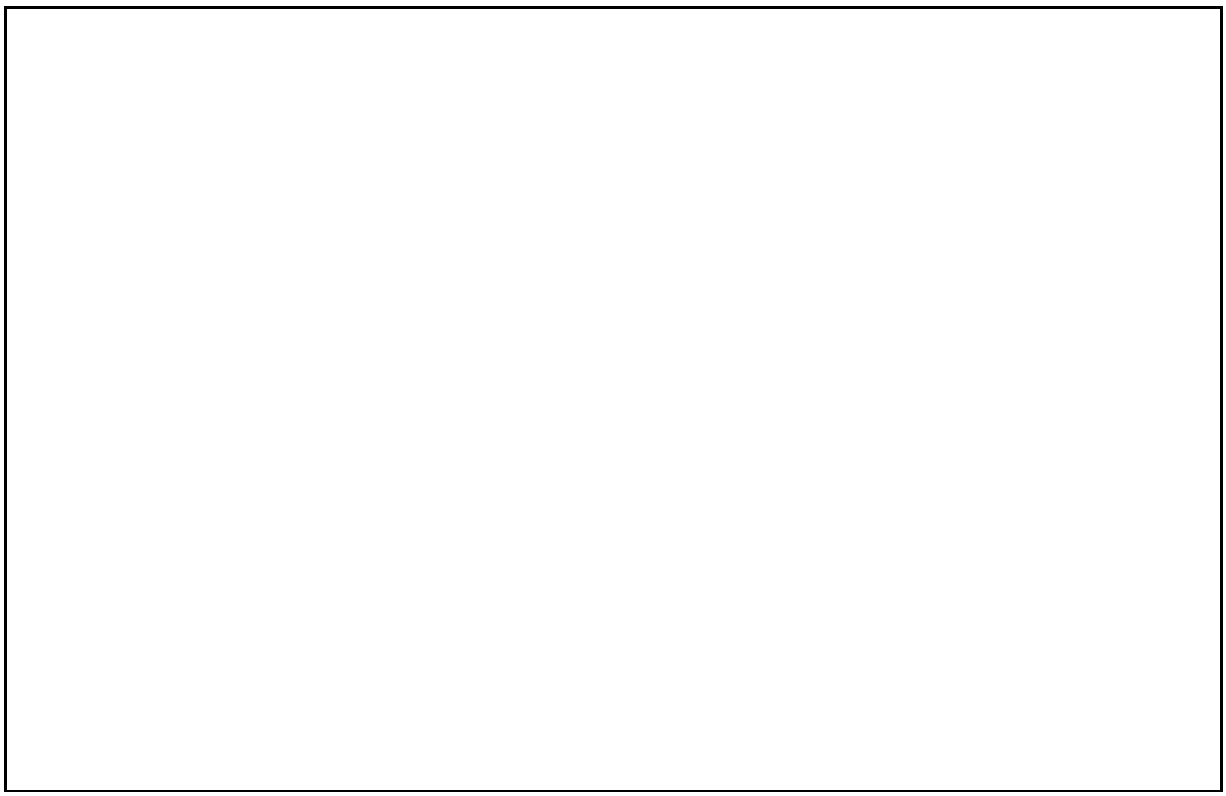
Example(s):

Independence of Events (2 / 3)

Example(s):



Independence of Events (3 / 3)



Probabilistic Reasoning (1 / 6)

Each drawer of a 3x2 dresser holds either a red or a blue UA T-shirt. One row of drawers has two red shirts, one row has two blue, and one row has one of each. You open one drawer and see a red T-shirt. What is the probability that the shirt in the other drawer in the same row is also red?

Photo Credit: overstock.com

Probabilistic Reasoning (2 / 6)

One solution approach: Enumerate the possibilities. WLOG:

Dresser

R_1	R_2
B	B
R_3	B

Open Drawer Containing	Shirt Color in Other Drawer?
R_1	
R_2	
R_3	

Probabilistic Reasoning (3 / 6)

A more famous, more recent, example:

"Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat. He then says to you, 'Do you want to pick door No. 2?' Is it to your advantage to switch your choice?"

From "Ask Marilyn", Parade, Sept. 9, 1990.

Reference:

`www.marilynvossavant.com/game-show-problem/`

Care to Play?

Probabilistic Reasoning (4 / 6)

But . . . why? Three views:

1. Enumerate the Possibilities

Probabilistic Reasoning (5 / 6)

2. ‘Car / Not Car’

Probabilistic Reasoning (6 / 6)

3. Conditional Probability