

## Formulas you will be given – know what they mean and how to use them

- $P(A) = \frac{n(A)}{n(S)}$
- $P(A^C) = 1 - P(A)$
- $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
- $P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$
- $P(A \text{ and } B) = P(A|B) * P(B) = P(B) * P(A|B)$
- **Disjoint Events:**  $P(A \text{ and } B) = 0$
- **Independent events:**  $P(A|B) = P(A)$   
 $P(B|A) = P(B)$   
 $P(A \text{ and } B) = P(A) * P(B)$

1) Find a coin.

- Flip the coin five times, what was the proportion of seeing a head?
- Flip the coin ten times, what was the proportion of seeing a head?
- Flip the coin twenty times, what was the proportion of seeing a head?
- Over time, say we flip a fair coin thousands of times, what do we expect the proportion of a heads to be IN THE LONG RUN?

2)

Draw the Venn Diagrams for the following probabilities – shade the region we're interested in.

a.  $P(A \text{ and } B)$

b.  $P(A^c)$

c.  $P(A \text{ or } B)$

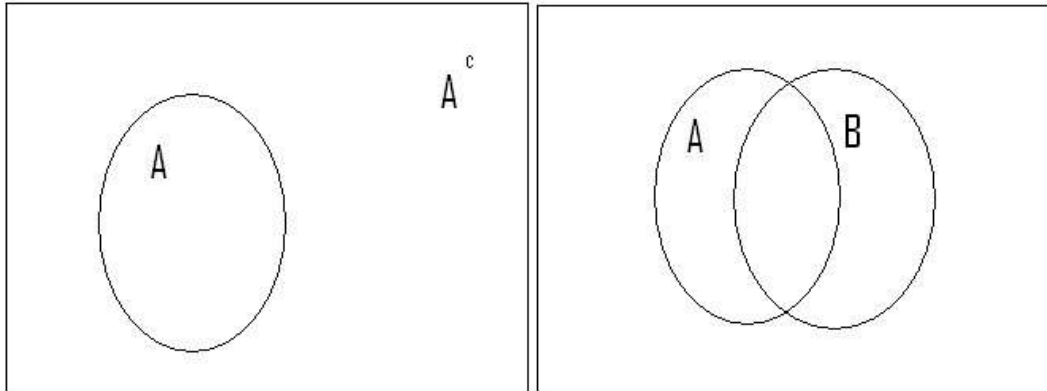
d.  $P(A)$

3)

Fill out the following diagrams for the events:

A = pulling an ace out of a deck randomly

B = pulling out a red card out of a deck randomly



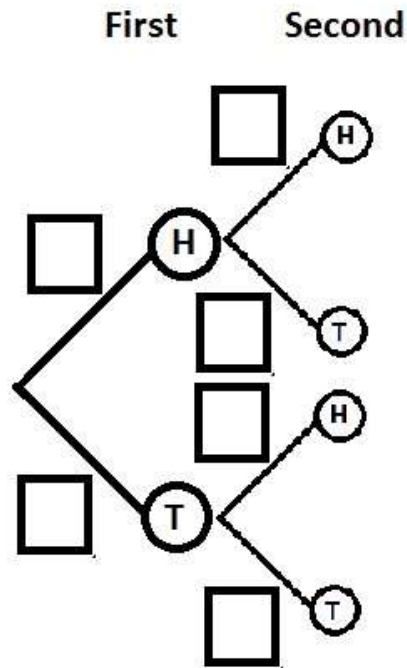
- a. What is the probability of pulling an ace out of a deck randomly,  $P(A)$ ?
- b. What is the probability of pulling a red card out of a deck randomly,  $P(B)$ ?
- c. What is the probability of pulling a red ace out of a deck randomly,  $P(A \text{ and } B)$ ?
- d. What is the probability of pulling a red card or an ace out of a deck,  $P(A \text{ or } B)$ ?
- e. What is the probability of pulling an ace out of the deck given that you pulled a red card,  $P(A|B)$ ?
- f. Are A and B independent events?
- g. Are A and B mutually exclusive? If not, name a mutually exclusive event for each.

4)

A woman, Sally Clark, was found guilty of the murder of her two sons. The chance of a family suffering sudden infant death syndrome was 1 in 8,500. Pediatrician Professor Roy Meadow, testified that the chance of two children from an affluent family suffering from sudden infant death syndrome was 1 in 73 million by calculating  $\left(\frac{1}{8500}\right) * \left(\frac{1}{8500}\right)$ . The judgment was that it was far too unlikely that the deaths were caused by the disease and must have been inflicted otherwise. Do you agree with the verdict, why or why not? If you don't agree explain why and state what additional information you would need.

5)

Fill out the following tree diagram for flipping an unfair coin, a coin that lands on heads three quarters of the time, and use to answer the following questions.



- e. Find the probability of the coin landing on heads for the first toss.
  
  
  
  
  
  
  
  
  
  
- f. Find the probability of the coin landing on heads for the second toss.
  
  
  
  
  
  
  
  
  
  
- g. Find the probability that two heads are flipped in a row.
  
  
  
  
  
  
  
  
  
  
- h. Find the probability that a head and a tail are flipped in the two tosses, regardless of order.









