The Addition Rule

The Probability of the Event {A or B} when A and B are Disjoint

The addition rule: If A and B are disjoint events, then

$$P(A \text{ or } B) = P(A) + P(B)$$

The Probability of the Event {A or B} when A and B are Not Disjoint

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

Example: Drawing a King or a Heart

Drawing a card from the top of a randomly shuffled deck, each card has a probability of $\frac{1}{52}$ of being drawn.

$P(\text{K})$ = Probability of drawing a king is $\frac{4}{52} = \frac{1}{13}$

because…

4 Kings

52 Cards

Example: Drawing a King or a Heart

Drawing a card from the top of a randomly shuffled deck, each card has a probability of $\frac{1}{52}$ of being drawn.

$P(\heartsuit)$ = Probability of drawing a heart is $\frac{13}{52} = \frac{1}{4}$

because…

13 Hearts

52 Cards

Example: Drawing a King or a Heart

So what is the probability of drawing a King *or* a Heart?

$P(\text{K})$ = Probability of drawing a king is

$$\frac{4}{52} = \frac{1}{13}$$

While P(♥) = Probability of drawing a heart is

$$\frac{13}{52} = \frac{1}{4}$$

?

Example: Drawing a King or a Heart

So what is the probability of drawing a King *or* a Heart?

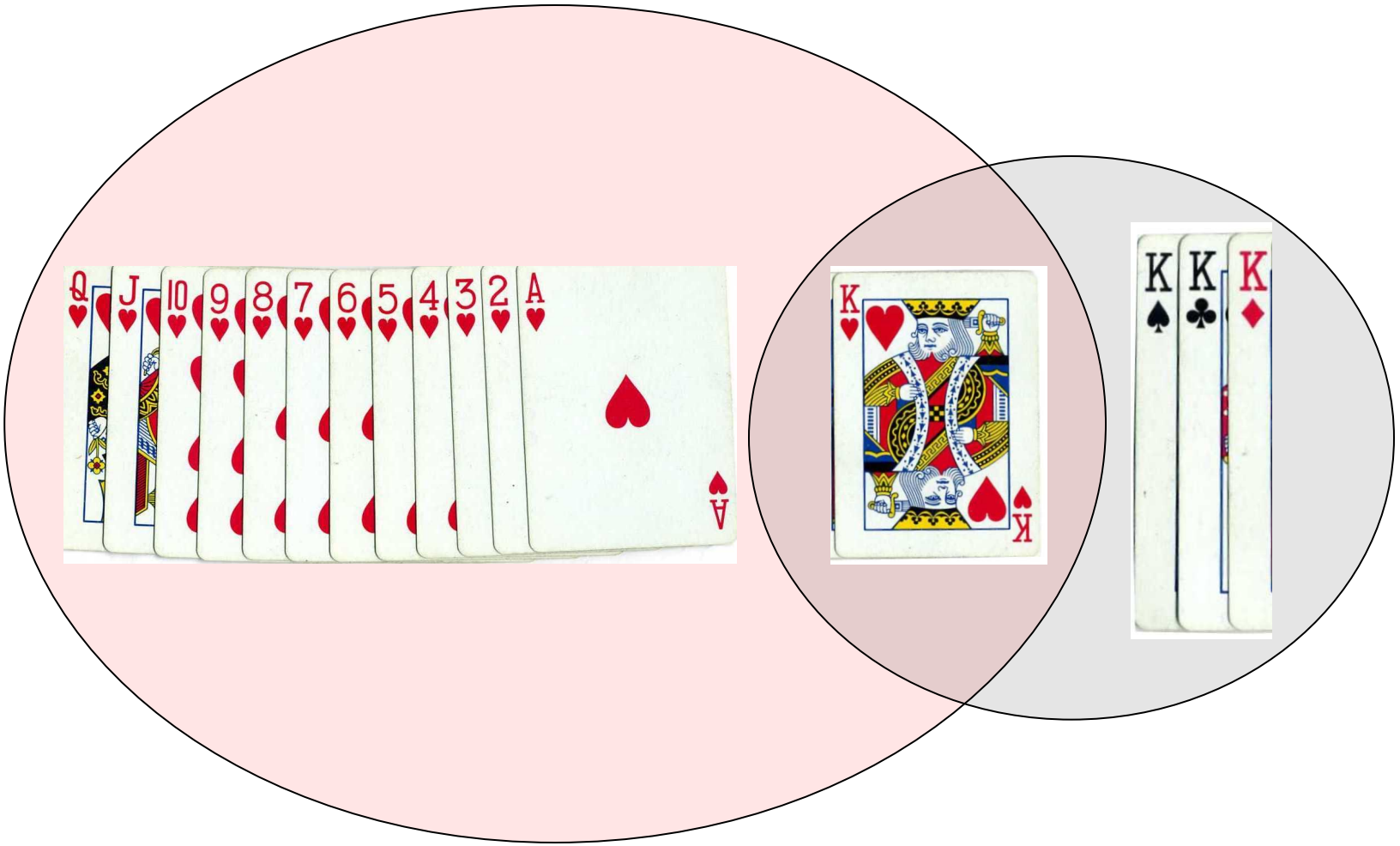
Note that there are 17 cards but…

2 King of Hearts

$P(\text{K or } \heartsuit) = 4/52 + 13/52 - 1/52$

$P(\text{K or } \heartsuit) = 16/52$

We can put this in Venn Diagram form:



Remember that the rest of this space is neither a King nor a Heart

So we end up with this formula:

P(K or ♥) = P(K) + P(♥) – P(K and ♥)

…and that leads us to the general formula:

The Probability of the Event {*A* or *B*} when *A* and *B* are Not Disjoint

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$